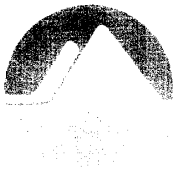


行政院所屬各機關因公出國人員出國報告書

（出國類別：　考察　　）

赴日本美國考察生物可分解塑膠認證制度

出國報告書

行政院環境保護署

服務機關：資源回收管理基金管理委員會

出國人　職　　稱：執行秘書

姓　　名：尤 泳 智(詳細名單如報告內文)

出國地點：日本、美國

出國期間：九十二年八月七日至八月十五日

報告日期：九十二年十一月三十日

行政院研考會/省（市）研考會編號欄
A0/09202298

考察日本美國生物可分解塑膠認證制度

出　國　報　告

目　錄

公務出國報告提要

報告名稱：赴日本美國考察生物可分解塑膠認證制度

主辦機關：美國穀物協會

聯絡人/電話：尤泳智/(02)2370-3860

出國人員：

尤泳智　行政院環境保護署資源回收管理基金管理委員會　執行秘書

于　寧　環境與發展基金會　總經理

黃建銘　中華民國環保生物可分解材料協會　理事長

畢修平　生物技術開發中心　環境生物技術專案計畫主持人

蕭耀貴　塑膠工業技術發展中心　副總經理

賴麗雅　偉盟工業股份有限公司　國外業務部副理

林明煌　旭農生物資源股份有限公司　總經理

張學義　美國穀物協會　駐台副代表

出國類別：考察

出國地區：日本、美國

出國期間：民國 92 年 8 月 7 日至民國 92 年 8 月 15 日

報告日期：民國 92 年 11 月 30 日

分類號/目：G13/工業安全及衛生

關鍵詞：生物可分解塑膠

內容摘要：

為減輕塑膠廢棄物所造成之環境污染問題，歐美國家及日本在生物可分解塑膠之研發與推展，曾投入不少的人力與物力，並已建立生物可分解塑膠之認證制度(Certification System for Biodegradability)，足堪我國借鏡。因此，美國穀物協會駐台辦事處特於2003年 8月 7日至15日組團前往日本考察生物可分解塑膠之認證制度與推廣現況，之後再前往美國科羅拉多州丹佛市參加第十一屆生物可分解塑膠國際研討會(The 11th Annual Meeting of the Bio Environmental Polymer Society)，以瞭解先進各國對於生物可分解塑膠認證制度之研發與推展情形。

本次考察團共有產、官、學、研各界對於生物可分解塑膠素有研究之專家學者八人，此行考察收穫良多，所收集之資料及經驗，將可供我國將來推動生物可分解塑膠認證制度之重要參考。

在此次國際研討會中，共有來自美國、法國、德國、比利時、丹麥、加拿大、澳洲、日本、韓國、中國大陸、台灣等十多個國家之專家學者一百一十多人發表有關之論文七十篇，歸納其發表之論文研究，可知在製造生物可分解塑膠之材料有：生物合成、化學合成及天然高分子三種。而真正具備生物完全可分解性之塑膠材料，均在1990年後才在世界各國被開發上市，我們稱為「第二代完全可生物分解產品」，而與第一代之崩解性部分生物可分解產品不同。在未來，生物可分解塑膠之發展趨勢，將朝著低成本及高性能方向來發展。

本次考察行程中的另一個重要任務，就是收集歐、美、日本等先進國家對於可堆肥化塑膠的驗證制度，在這方面，我們已收集到德國DIN CERTO、美國BPI及日本BPS之推展方式有關資

料，將可供我國有關單位參考，俾便日後加入國際合作，以加速推展可堆肥化塑膠產品之應用，減少對環境之衝擊。

考察日本美國生物可分解塑膠認證制度

壹、前言

為減輕塑膠廢棄物所造成之環境污染問題，歐美先進國家及日本在生物可分解塑膠之研發與推展，曾投入不少的人力與物力，並已建立生物可分解塑膠之認證制度(Certification System for Biodegradability)，足堪我國借鏡。因此，美國穀物協會駐台辦事處特於2003年 8月 7日至15日組團前往日本考察生物可分解塑膠之認證制度與推廣現況，之後再前往美國科羅拉多州丹佛市參加第十一屆生物可分解塑膠國際研討會(The 11th Annual Meeting of the Bio Environmental Polymer Society)，以瞭解先進各國對於生物可分解塑膠認證制度之推展情形。

本次考察團共有產、官、學、研各界對於生物可分解塑膠素有研究之專家學者八人，此行考察收穫良多，所收集之資料及經驗，將可供我國將來推動生物可分解塑膠認證制度之重要參考。

在此次國際研討會中，共有來自美國、法國、德國、比利時、丹麥、加拿大、澳洲、日本、韓國、中國大陸、台灣等十多個國家之專家學者一百一十多人，發表有關之論文七十篇(詳見附錄二)，歸納其發表之論文研究，可知在製造生物可分解塑膠之材料有：生物合成、化學合成及天然高分子三種。而真正具備生物完全可分解性之塑膠材料，均在1990年後才在世界各國被開發上市，我們稱為「第二代完全可生物分解產品」，而與第一代之崩解性部分生物可分解產品不同。

在未來，生物可分解塑膠之發展趨勢，將朝著低成本及高性能方向來發展。

本次考察行程中的另一個重要任務，就是收集歐、美、日本等先進國家對於可堆肥化塑膠的驗證制度，在這方面，我們已收集到德國DIN CERTO、美國BPI及日本BPS之推展方式有關資料，將可供我國有關單位參考，俾便日後加入國際合作，以加速推展可堆肥化塑膠產品之應用，減少對環境之衝擊。

貳、考察期間

中華民國九十二年八月七日至八月十五日，為期九天

參、出國考察人員

尤泳智　行政院環境保護署資源回收管理基金管理委員會
　　執行秘書
于　寧　環境與發展基金會　總經理
黃建銘　中華民國環保生物可分解材料協會　理事長
畢修平　生物技術開發中心　環境生物技術專案計畫主持人
蕭耀貴　塑膠工業技術發展中心　副總經理
賴麗雅　偉盟工業股份有限公司　國外業務部副理
林明煌　旭農生物資源股份有限公司　總經理
張學義　美國穀物協會　駐台副代表

肆、考察訪問與參加研討會行程

日　期	行　　程
8月7日 (星期四)	搭乘美國航空公司班機自中正機場啟程至日本東京 (夜宿東京 ANA HOTEL)
8月8日 (星期五) 09：00~10：00	拜訪美國穀物協會日本東京辦事處(USGC/Tokyo Office) 由副代表　Hiroko Sakashita　接見並作簡報，說明日本推廣生物可分解塑膠之情形。
10：30~11：30	拜訪日本生物可分解塑膠協會(Biodegradable Plastics Society，簡稱 BPS) 由 Mr. Kanai 接見，並說明日本 BPS 之組織、活動、認證體系及日本生物可分解塑膠之市場現況。
14：00~15：30	拜訪日本有機資源協會(Japan Organics Recycling Association，簡稱 JORA) 中華民國環保生物可分解材料協會理事長黃建銘博士亦在會中介紹我國可堆肥塑膠認證制度之推行現況(詳見附錄一)。 (一)先由亞洲有機回收網(The Asia Network of Organics Recycling，簡稱 ANOR)之指導委員會主席 Dr. Chino 致歡迎詞。 (二)東京農業大學教授 Dr. Ushikubo 說明日本推動堆肥之情形。

日　期	行　　程
	(三)JORA 副理事長 Dr. Tadano 介紹日本之堆肥認證制度。 (四)JORA 副理事長 Mr. Yoshihiro Maruyama 介紹 ANOR 的有關活動。 (五)最後由 JORA 國際關係委員會主席 Mr. Takeshita 做總結說明。
16：00~17：00	參觀日本東京之「日本科學未來館」(National Museum of Emerging Science and Innovation，NMESI) 瞭解日本對於社會大眾如何宣導綠色產業及生物可分解塑膠之應用情形。(夜宿東京 ANA Hotel)
8 月 9 日 (星期六)	搭乘美國航空公司班機自日本東京至美國科羅拉多州丹佛市(夜宿丹佛市 Hyatt Hotel)
8 月 10 日 (星期日)至 8 月 13 日 (星期三)	參加第十一屆生物可分解塑膠國際研討會 【The 11th Annual Meeting of the Bio Environment Polymer Society （B EPS）】
8 月 14 日 (星期四)	搭乘美國航空公司班機離開丹佛市
8 月 15 日 (星期五)	下午九時十分抵達中正機場

伍、考察訪問重要成果紀要

甲、拜訪機關部分：

一、美國穀物協會日本東京辦事處(U.S.G.C./Tokyo Office)

美國是目前全球穀物最大的生產地，也是最大的供應國，為支援海外各國善用穀物以發展畜牧事業與穀物加工業，美國的農民與相關的農業公司於 1960 年相率建立這個非營利性的私立機構－美國穀物協會(U.S. Grains Council)。以推廣玉米、高粱和大麥在飼料、工業及食品業之應用。其總部設在華盛頓特區，並且在全球各地建立十所海外辦事處(台灣辦事處係於 1973 年成立)，經由這個工作網，目前正在 100 個以上的國家從事技術協助工作。

美國穀物協會駐日本辦事處(U.S.G.C./Tokyo Office)係 1961 年於東京成立，自此日本之家畜產品與穀物進口數量已有顯著增加。目前日本已是美國穀物最大的進口國，其進口之實務操作面上亦與美國出口作業相互契合。目前日本自美國進口之穀物主要是玉米，而玉米中所含的澱粉可以做成 PLA(Poly lactic Acid 聚乳酸酯)，其比例大約是每 4 噸澱粉可做成 1 噸的 PLA。PLA 係做為生物可分解材料，可研發製成包裝材、農業覆蓋膜、汽車零件、地毯、輪胎等物品。

該辦事處自 1992 年 10 月起在日本推廣生物可分解塑膠(Biodegradable Plastics)，並協助日本生物可分解塑膠協會(Biodegradable Plastics Society ，簡稱 BPS)推展生物可分解塑膠認證制度，以及大力支持日本有機資源協

會(Japan Organics Recycling Association，簡稱 JORA)，積極推動堆肥處理認證工作。

該辦事處現任代表是 Cary B. Sifferath ，此次拜訪時剛好回美國述職，故由副代表坂下洋子(Hiroko Sakashita)出面接見本團團員，有關該辦事處近十年來之主要活動情形詳見附錄三。

二、日本生物可分解塑膠協會(BPS)

當我們拜訪日本生物可分解塑膠協會時，是由該協會理事長大島一史(Dr. Ohshima, Kazushi、企劃調查委員會委員長金井康矩(Mr. Kanai, Yasunori)出面接見及介紹日本生物可分解塑膠認證制度之推展情形(詳見附錄四)，而本團團員之一的中華民國環保生物可分解材料協會理事長黃建銘博士亦在拜會中介紹我國「可堆肥化塑膠標章認證管理辦法」，(詳見附錄一)，頗受日本 BPS 重視。

日本生物可分解塑膠協會(Biodegradable Plastics Society，簡稱 BPS)係於 1989 年 10 月成立的，現有 155 個會員及 20 個公司團體會員，其主要任務是要建立所有與生物可分解塑膠有關之技術，並設法將生物可分解塑膠產品引導至商業用途。至今該協會已發展 414 種生物可分解塑膠產品，對於每一件產品之申請驗證手續費為 1000 日圓，而全部驗證費大約在 50 萬日圓至 100 萬日圓間。該協會於 1995 年開始發展「綠色塑膠」標章的制度。

日本 BPS 設有執行委員會(Executive Board)，係由15 家公司組成，另為推動相關工作之需，BPS 下設有三個委員會：

(一)研究與計畫委員會(Research and Planning Committee－主要是從事有關生物可分解塑膠之研究與計畫事宜。

(二)技術委員會(Technology Committee)主要工作是做有關生物可分解塑膠之：1.技術評估與發展事宜，2.現場測試與評估工作，3.生命週期分析，及 4.標章產品之規劃工作。

(三)認證委員會(Certification System Committee)

又可分「科學」、「標準」、「標章檢查」及「裁判」四部，分來推展生物可分解塑膠之認證事宜。

日本 BPS 之主要活動有：1.評估方法之建立，2.相關資料之收集與分析，3.與其他機關之資訊交換，4.宣導教育之推廣。

三、社團法人日本有機資源協會(JORA)

當我們拜訪社團法人日本有機資源協會(Japan Organics Recycling Association，簡稱 JORA)時，該協會甚表歡迎，由該協會副會長兼技術委員會委員長但野利秋(Dr. Toshiaki Tadano)、副會長兼機關誌編集委員會委員長茅野充男(Dr. Mitsuo Chino)、國際交流委員會委員長竹下英一(Mr. Eiichi Takeshita)、企劃委員會副委員長牛久保明邦(Dr. Akikuni Ushi kubo)及事務局主幹上田敏

文(Mr. Toshifumi Ueda)、丸山義弘(Mr. Yoshihiro Maruyama)、及專務理事宇井勝昭(Mr. Yoshiaki Ui)等人出面接見，並詳細說明日本有機資源協會之工作狀況(詳見附錄五)。

日本於2001年公布「循環再利用法」，強調廢棄物之處理要符合3R的原則，也就是要使廢棄物減量(Reduce)、再使用(Reuse)及回收(Recycle)，希望推動資源循環再利用型之社會，呼籲社會大眾減少大量生產、大量消費而產生大量廢棄物，因此，日本政府特別將2001年訂為「循環再利用年」。希望藉此積極推動「回收的社會」，以達到：1.廢棄物減量，2.促進循環再利用，3.合理且適當的再處置，以及4.最後要將廢棄物安全的處置。

此外，日本在2001年5月又公布「食品回收法」，希望能減少食品廢棄物的產生量。因為日本的食品廢棄物已佔所有垃圾量的三分之一，而目前食品廢棄物的處理方式大多以掩埋和焚化為主。所以，日本對於「凡是沒有被賣掉或吃掉的食品，皆認為是食品廢棄物」，要求有關的食品製造商、經銷商及量販店要負回收之責。

至於回收的食品，則可以製成飼料、油、沼氣及發酵產品。當食品廢棄物被脫水、乾燥、發酵等處理後，可以轉化為二氧化碳和水，可使食品廢棄物之體積減量。

目前日本之食品廢棄物之處理上面臨以下之問題：1.食品廢棄物之數量、品質不一致；2.食品廢棄物之含水份很高，大約在85%以上，而一般做堆肥的食品以

含水量在55%至60%為最佳，所以食品廢棄物之處理要先去除水分；3.鹽份過高也是問題(一般含量在 3%至5%)；4.油份大約佔 12%，雖然油份可做為堆肥細菌之能量來源，但如果處理時間不夠，油份未能充分分解，則將對植物造成傷害。

至於分類後的食品廢棄物可產出沼氣和作堆肥使用，目前日本政府機構是每星期有三天從事食品廢棄物之回收，但現在仍未強制規定民眾要回收食品廢棄物。

另外，日本已公布「堆肥管制法」，法律規定堆肥之重金屬和有機物含量不能危害到植物之生長，並已建立一套完整的堆肥驗證系統，要求業者必須向農林水產省申請獲准後才可從事堆肥業務，如一旦通過驗證，其有效期間為三年，而其驗證內容會註明「不同的肥料，有其重金屬之最高含量」，假如販售由污泥做成的肥料，則要有「證明書」，如果是由外國進口的材料做成肥料，也會事先查明清楚。當然，從事製造堆肥之業者，也要向地方政府申請登錄，獲得許可，並在其產品上註明堆肥之主要營養成分。

乙、重要成果紀要

此次受美國穀物協會邀請，參加在美國科羅拉多州首府丹佛市舉辦之第 11 屆生物可分解塑膠國際研討會(The 11 th Annual Meeting of the Bio Environmental Polymer Society，簡稱BEPS)，且途經日本東京，曾拜訪了美國穀物協會在東京的辦事處(USGC/Tokyo office)、日本生物可分解塑膠協會(Bio

degradable Plastic Society，簡稱 BPS)及日本有機資源協會(Japan Organics Recycling Association，簡稱 JORA)，以進步瞭解日本在生物可分解塑膠材料之應用及發展，同時也瞭解到日本對有機廢棄物回收處理情形，受益匪淺。

茲將此次考察之心得，摘要敘述如下：

一、全球生物可分解塑膠材料之發展趨勢

(一)生物可分解塑膠之三大製造方法

此次 BEPS 會議中，來自歐、美、日、中國大陸、台灣等國之專家學者一百一十多人，發表之論文有 70 篇，歸納其發表之論文研究，在製造生物可分解塑膠之材料方面不外乎以下三種：

1.生物合成

(1)在自然界，有許多微生物會在體內形成聚酯以作為貯存能量之物質，使用生物合成之方法，這些微生物可在最佳條件下有效地發酵形成聚酯。

(2)因為自然界有些微生物會分解上述其他微生物所生成之聚酯以作為營養源，於是生物可分解性變得實際可行。此種聚酯同時具有熱塑性。

(3)此類生物可分解塑膠，例如：Polyhydroxy Butyrate Valerate(PHBV)。

2.化學合成

(1)大部份化學合成之高分子材料都不會被微生物分解，不過，脂肪族聚酯及水溶性高分子材料

可以輕易地被微生物分解，這兩類高分子材料可以用化學方法合成。

(2)兼具有兩種佔優勢的性質:在水份保持力、強度、加工性、熱塑性及其它物性上與傳統塑膠相類似，具有生物可分解性。假如生產量可以擴大，則由於可以使用傳統化學合成技術，因此生產成本可相當容易予以降低。

(3)此類生物可分解塑膠，例如：Poly-lactic Acid (PLA) Poly vinyl alcohol(PVA)及Poly-aprolactone (PCL)等。

3.天然高分子

可以使用纖維素、澱粉及其他天然高分子材料來製造生物可分解塑膠，假如所使用之天然高分子沒有經過任何化學改質，則其物理性質(例如:強度及水份保持性)會有問題，因此，在大多數的情況下，都會進行化學改質。由於使用天然材料，因此生物可分解性高，而且，當使用澱粉及其他較便宜之物質時，有助於產品成本之下降。

雖然上述三類製造方法具有不同的物性及生物分解性，但是彼此間卻並非互不相關，目前有一種製造方法是把天然高分子與生物可分解性高分子材料(生物合成或化學合成)進行摻合，透過一種將數類生物可分解性材料互相摻合的方法，可以把各類生物可分解性材料在物理、生物分解性及價格上之優缺點互相調配。

(二)全球主要之生物可分解塑膠供應商及應用市場

真正具備生物完全可分解性之塑膠材料，均在1990年後才在世界各國被開發上市，我們稱為第二代完全可生物分解產品(第一代為崩解性部分生物可分解產品)，目前全球主要供應商如下表：

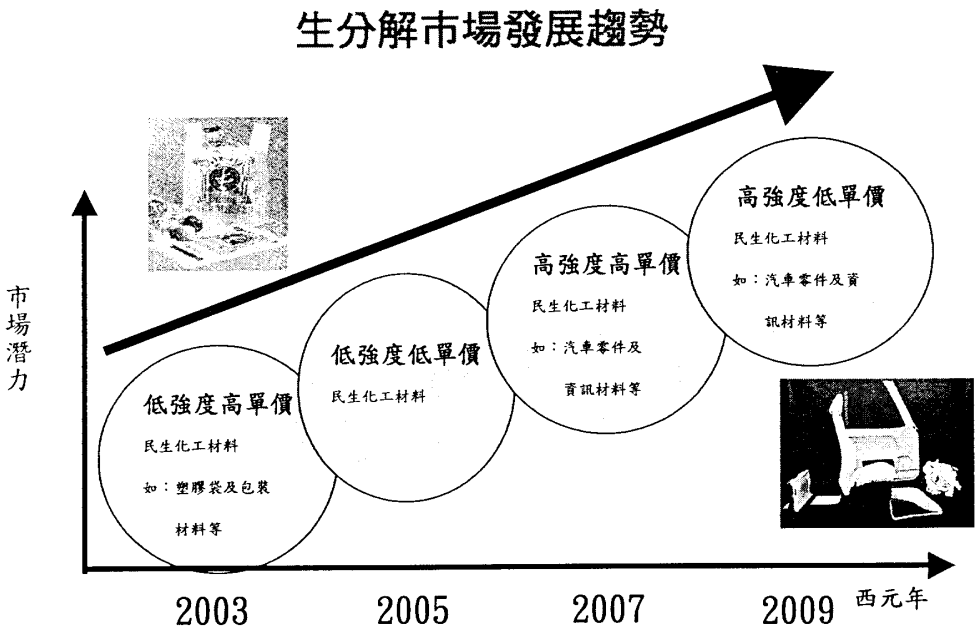
國別	公司名稱	產品名稱
美國	Cargill-Dow	EcoPLA
美國	Union Carbide	Tone
美國	Planet	PLANET
美國	Dupont	Biomax
美國	Eastman	EastarBio
比利時	Solvay	CPPA
義大利	Novamont	Mater-bi
英國	ICI	Biopol
日本	島津	Lacty
日本	昭和高分子	Bionolle
日本	三井東壓	LACEA
日本	Nippon	Gosenol
日本	Daicel	CelGreen
日本	Mitsubishi Gas	Iupec
日本	Chisso	Novon
德國	BASF	Ecoflex

根據此次 BEPS 會議中，美國 BioPlastic polymers and Composites 公司 Michael Satkowski 在他的報告〝Biodegradable materials opportunity

Analysis〞中指出，由於目前生物可分解性塑膠材料之單價太高，因此尚難普及，再加之其物性僅達一般泛用塑膠材料之水準，因此用途有限，目前世界各國主要的用途均集中在包裝用材、農業資材及少數生醫用材。對於未來發展有二方面值得努力：一方面是努力降低材料成本，使其更能普及到各種用途，目前此一方向各國均在努力尋求突破，此次BEPS 會議中，就有不少利用各種混練(Compounding)技術來研究降低成本的方法；而在另一方向，係努力提高生物可分解塑膠材料之性能，使其具備工程塑膠等級之強度，如此就可提高其應用層次及價值，例如：日本 SONY 公司之最新隨身聽機身主體即採用 PLA 所開發出來的材料，還有 TOYOTA 公司的汽車的內裝飾板也在試用高耐熱及高耐久性的生物可分解性塑膠。

(三)未來生物可分解塑膠之發展趨勢

未來生物可分解塑膠之發展方向，將朝低成本及高性能方向來發展，低成本的開發將促使生物可分解塑膠材料在既有的應用市場更加普及化，而高性能的開發將把生物可分解塑膠材料推向更高的附加價值市場，例如：資訊產品外殼、汽車內裝件、室內建材及生醫器材等領域。綜合歸納而言，生物可分解塑膠的發展走向，可用下面的「生分解市場發展趨勢圖」(Road Map)來表示。



二、參加第十一屆生物可分解塑膠國際研討會之收穫

本次會議中，介紹很多新生物可分解塑膠種類及材質，並提供如何應用生物科技來改進目前已開發出材質，如 PLA(Polylactic Acid)及 PHA (Polyhydroxy alkanoates)也有一些法規及市場資訊，尤其是在生物可分解塑膠市場中，幾個重要製造者也都參與此次會議。茲將本次研討會中與我們工作有相關性的數項生物材料之新研發成果略述如下：

(一)PHA 是生化合成的生物高分子材料——PHA 可完全分解為 CO_2 及 H_2O，一直都特別受到重視，也是今年討論的重心之一，但因傳統之生產成本過高，乃是此材料發展最大的限制，目前的研發工作多為克服此困難。

1.Yoshiharu Doi 團隊(Polymer Chemistry Laboratory, RIKEN Institute, Hirosawa)針對聚-β-羥基丁酸酯 P(3HB-*co*-3HHx) 進行模擬試量產技術開發，Doi 教授以黃豆油為主要之碳來源來替代葡萄糖，生產的菌种是把 PHA synthase 基因從 *Aeromonas caviae* 轉殖到 *Ralstonia eutropha* recombinant strain ，探討就其生產費用，且分析生命週期內之能源需求及產出物 CO_2 排放量，估算出年產 5000 噸時，生產成本與傳統應用葡萄糖為碳源時之生產成本相比較，結果非常相似，大約 3.5~4.5US$/kg，與石化產品相較，在能源需求及產出物 CO_2 排放量上就有明顯的減量現象。另外，薄膜的強度及韌性，在新開發的製作技術也有很大的突破。

2.Doi 教授團隊內的其他學者也分別報導進行加強合成 PHA 關鍵酵素的基因工程技術，經過人為的更動後，PHA 合成酵素能提供更高效率，例如：將 3-ketoacyl-ACPsynthase (*fabH*) gene 、3-ketoacyl-ACP reductase (*fabG*) 與 polyhydroxyalkanoate synthase (*phaCI*) gene 殖入 *E. coli* 後，在以葡萄糖為碳源時，*E. coli* 生產短鏈及中鏈聚-β-羥基丁酸酯 (SCL-MCL PHA)量會增加，將 PHAsynthase gene 經 PCR-mediated mutagenesis 後，可改變聚合物中的單一物的成分量，進一步未來可應用在調控生產聚合物中 3HB 在 3HA 的含量。

3.P&G 公司開發的 Nodax 高分子材料，其主要原料也是屬聚-β-羥基鏈烷酸酯（PHB-A）聚合物，其材質在拉伸力強度及隔熱能力與聚乙烯極為相似，對染料及絕緣体的親和性上也保有聚酯纖維特性。P&G 公司為擴大市場的需求，特將 PLA 與 PHA 混合聚合，具有高分子 的特別優良的物理特性。

4.Metabolix 公司為了降低生產成本，分別利用植物的醣類及油類作醱酵生產 PHA 原料，然而生產方式仍依賴於微生物發酵，成本過高，限制其應用，目前由美國農業部提供兩百萬美元之經費研究細菌 PHB 合成途徑基因導入植物，以植物爲生物反應器生產 PHB，以降低成本.

(二)較突出的是歐洲生物可分解材料之市場報導－其中特別提出 Kassel project，也分別說明新國際性 International Compostability Certification Network (ICCN)是基於原有的國際標準而衍生出，而分別為美國 Biodegradable Products Institute (BPI)、日本 the Biodegradable Plastics Society (BPS) 及歐盟 DIN CERTCO 所採用。

(三)PLA（polylactic acid，聚乳酸酯）是生物可分解物質－PLA 也是本年討論重心之一，目前因其生產較 PHA 便宜，特別受到重視，PLA 是由乳酸聚合的新型聚酯。乳酸(lactic acid)是於 1850 年，美國 Sdude 首次從酸奶中發現的。乳酸不揮發，無氣味。乳酸

有三種結構形式，若經減壓蒸餾和分步結晶，可得純晶體，其熔點隨分子結構不同而不同。 由於乳酸分子中同時具有羥基和羧基，因此兩個乳酸分子之間可進行酯化。生成了聚酸乳酸的製造方法目前主要有三個途徑：即澱粉發酵法，乙醛—氫氰酸法，丙烯法。目前製造聚乳酸最有價值的反應還是含澱粉的農作物發酵法。 乳酸在釀造、食品、醫藥、化妝品、皮革、農業等領域有廣泛的應用，尤其在手術縫合線和骨科固定材料方面有越來越大的需求。

1.美國、日本、法國都在研究乳酸製造 PLA 技術，例如：2000 年 8 月，美國 Cargill 公司與美國 Dow 化學公司公佈，他們已建立了世界上第一個由玉米發酵法生成 PLA 的工廠。德國、日本也都分別採用澱粉發酵以及有機酸、有機醇試製 PLA 聚酯。德國的 Inventa—Fischer 公司於 1998 年也開發了成本低廉的 PLA 生產方法。其實驗裝置的能力為 3000 噸/年。這套裝置在 2001 年建成，黑麥被選為 PLA 的原料，生產 PLA 與玉米一樣，保証 PLA 的質量，與 PET 聚酯比較，PLA 具有更優良的特性和優勢。最顯著的優勢就是 PLA 的原料可以來自植物，也可以來自化工原料，與 PET 單獨依賴石油資源相較，更具有可持續發展的優勢。而農作物是一年一成熟，因此這種資源是可再生的。

2.Mitsui Chemicals 公司為配合消費者需求，將PLLA(Poly L-lactic Acid)的物理性及機械性作進一步的改質，一方面與 aliphatic biodegradable polyester melt-blend，可以將 PLLA 硬而脆的特性柔軟化，另一方面因添加 PAL(amphiphilic biodegradable polymer synthesize from aspartic acid and L-lactide) 在 PLLA 高分子聚合物中可加強生物分解性。

(四)除 PLA 及 PHA 外之其他生物高分子材質之報導－例如：利用 L-aspartic acid 作聚合高分子，近期內已有很大的突破，衍生出一系列異於傳統而有新功能之生物可分解高分子產物。

(五)在生物高分子應用上之特別報導－近年來因木材量短少，使得塑木複材受到更大的重視，尤其是傢俱與廚櫃普遍可用纖維板、粒片板來替代天然木料，是經濟而實惠的替代品，目前工業上塑木複材製造時，使用 formaldehyde-based resins，例如：urea-formaldehyde resin 當作粘合劑，而 formaldehyde-based resins 是石化產品，在粘合劑成品初製成時會逸出少量甲醛氣體，而甲醛有致癌性，所以以 formaldehyde-based resins 為粘合劑的塑木複材是有礙身體健康，非常不適合作家庭中傢俱與廚櫃。目前已研發出取代物是一種生物粘合劑，材質是用黃豆蛋白，而黃豆本身含有 53%protein, 30%carbohydrate, 18% fiber，黃豆蛋白質可直接用來生產粘合劑，可

以立即解決塑木複材的困境。

(六)在提昇生物可分解材料之分解率方面－在會議期間，本團團員曾與 Dr. Tokiwa (National Institute of Advanced Industrial Science and Technology, Japan) 討論如何提昇微生物對生物可分解材料的分解率，Tokiwa 等人在 2002 年發表的文獻(Macromol. Biosci. 2002,2,420-428) 中提出 PLA、PHA 及 PBS 雖是生物可分解的，但埋在土中的生物分解率卻不高，為了進一步了解土中微生物分解生物高分子機制，分別分離、篩選及鑑定這類微生物。已被分離出分解 PHA、PCL 及 PBS 土中微生物種類很廣，而非局限於某單一類的微生物，分佈排序為 PCL= PHB > PBS > PLA。

能分解 PLA 的微生物有細菌、真菌及放線菌，但在自然界中針對能分解高分子量的 PLA 菌株並不普遍，分離出分解 PLA 的微生物多屬在放線菌中 *Amycolatopsis*。

Tokiwa 等人從兩個菌種中心 Japan Collection of Microorganisms (JCM) 及 Institute for Fermentation, Osaka (IFO) 中選出 41 屬(105 種) 放線菌，分別用 16S rRNA 序列(DDBJ/EMML/Genebank DNA sequence data libraries)探討這些微生物親緣演化關係(GENETYX 9.0 and CLUSTAL program)，能分解 PLA 菌株歸屬在 Pseudonocardiaceae family 內，包括 *Amycolatopsis, Saccarothrix, Lentzea, Kibdelosporangium* 及 *Streptoalloteichus*，大多數能分解 PLA 的菌株是在 *Saccarothrix* 屬內。

這篇文獻特別說明用分生親緣演化的方式是一種非常有效的技術來篩選 PLA 分解菌，使人了解環境中之 PLA 分解菌生態，未來分離純化這類的菌株將可用在提昇 PLA 廢棄物的分解率，或用在評估 PLA 生物可分解率，總之，最重要的還是要減少環境中日積月累之塑膠廢棄物。

三、收集可堆肥化塑膠之驗證制度資料

由於本次考察團之另一重要任務為收集先進國家推動『可堆肥化塑膠』之驗證制度，因此，除於考察期間與相關人員進行會談交換經驗外，並收集相關資料後彙整為以下兩部分：(1) 德國 DIN CERTO，美國 BPI 及日本 BPS 之合作協議書：此份協議書將可供我國參考，俾能加入國際合作以加速推廣可堆肥化塑膠。此份協議書雖僅侷限於實驗室之相互承認，但亦可提供於 2003 年 12 月（簽署後兩年）評估是否可依據國際標準（如 ISO/IEC Guide 65 或 EN 45011 或 JISQ 0065）提供驗證機構之認證服務。因此對此項發展應密切注意。(2) 日本生物可分解塑膠協會之 “Green Pla” 標章鑑別與標示系統：此係描述 BPS 如何認定生物可分解材料之基準與流程，亦可做為我國推動『可堆肥化塑膠標章』之參考。茲分述如下：

(一)德國 DIN CERTO，美國 BPI 及日本 BPS 之合作協議書(詳見附錄六)

1.一般事項

(1)DIN CERTO，BPI，BPS 已建立了如何辨別符合具有科學基礎的規格之「可堆肥化」與「可生物分解」材料/產品之驗證與鑑定計畫。

(2)DIN CERTO，BPI，BPS 已承諾將依據類似之固有生物可分解性、崩解性及生物毒性量測方法發展驗證系統。DIN CERTO 採用之測試與驗證標準為 DIN V54900-1 至-3，DIN EN 13432 及 ASTM D6400-99。BPI 之測試與驗證標準為 ASTM D 6400-99；BPS 之測試與驗證為 JIS K6950，JIS K6951，JIS K6953 及 Green Pla 為量測生物可分解性之鑑別與標示系統（2000 年 4 月第一版）。此外，BPS 目前正在發展評估崩解性之測試與規格中。

(3)DIN CERTO，BPI，BPS 藉由此協議，將測試實驗室之認可與測試報告之接受予以一致化，俾能加速擴大生物可分解/可堆肥化材料與產品之使用。

(4)本協議認知塑膠產品欲通過各機構驗證時，亦須符合其國家與地區性法規，特別是與重金屬含量限制及生物/植物毒性標準有關之法規。

2.合約主體

DIN CERTO，BPI，BPS 將發展並維持一致化系統，以認可生物可分解/可堆肥化材料與產品之測試報告及測試實驗室。

3.測試實驗室之認可

(1)測試實驗室必須符合第 4 節所列之準則，始能被本合約簽署單位認可。

(2)測試實驗室僅需受到本合約任一簽署單位認可。

(3)測試實驗室需證明其已具有第 4 節所列測試能力，並滿足必要之要求事項，始能被認可。上述證明可藉由適當之認證取得。否則接受該測試實驗室申請認可之本合約簽署單位必須執行稽核。

(4)測試實驗室若無法證明其已具有依第 4 節所列出之必要測試能力時，需每三年接受一次稽核。稽核報告應於稽核結束後之一定時間內送達本合約的每一個簽署單位。而稽核須依循類似於認證之程序執行。

下列之考量面須被評估並接受：

- 實驗室之獨立自主性。
- 組織與人員：組織圖、資格、經驗、獨立性、權責之明確定義、具有足夠之人力、汰換系統、在職訓練。
- 品質保證計畫：可取得性、量測之審查與管制、數據、計算及由並非直接參與測試之品管經理所做出之報告。
- 設備：足夠規模、可使用性、空間配置、檔案保管室、適當之廢棄物處置。
- 器皿、材料、試劑及樣品：維護、校正、確定、容量、標示。

- 測試系統：完整性檢查、污染、實驗室間比較測試之參與。
- 測試與參考物質：購入、儲存、鑑別、穩定性及保管。
- 所有測試實驗室內活動，包括修正與誤差之標準作業程序。
- 研究：研究計畫之存在、完整之報告、結果之可溯性、計算及原始數據。
- 紀錄與材料之儲存與保管。

(5)認可某測試實驗室之本合約簽署單位須負責持續監督該測試實驗室，俾能確保其符合第 4 節之規定。

(6)若某測試實驗室於上述監督期間被發現並被告知有連續之不符合第 4 節規定情事且不即時修正時，其認可將被撤消。

4.測試實驗室之要求事項

(1)測試實驗室應依據 ISO/IEC 17025「測試與校正實驗室能力之一般要求事項」標準，JIS Q 17025「測試與校正實驗室能力之一般要求事項」，EN 45001「測試實驗室操作之一般性準則」，ASTM E 548-94e1「為評估實驗室能力所使用的一般性準則之標準指南」及 OECD 良好實驗室作業之基本條件（GLP）或由各級政府所訂之同等規範執行其測試。

(2)如本合約簽署單位認可之測試實驗室係依據各

級政府所訂之同等規範所認可時，本合約其他簽署單位應被告知該規範，俾能檢查其是否與上述之 ISO/IEC 17025「測試與校正實驗室能力之一般要求事項」標準，JIS Q 17025「測試與校正實驗室能力之一般要求事項」，EN 45001「測試實驗室操作之一般性準則」，ASTM E 548-94e1「為評估實驗室能力所使用的一般性準則之標準指南」及 OECD 良好實驗室作業之基本條件（GLP）相當。

(3)測試實驗室應獨立運作，保持中立。不受任何經濟依存性影響，例如：可能的所有權結構或合約關係。

(4)鼓勵測試實驗室與其他認可實驗室交換經驗，俾能改善測試方法之有效性與正確性。

(5)與認可條件相關之改變應及時通知認可該測試實驗室之本合約簽署單位。

(6)測試實驗室應將所有因執行測試活動而獲得之所有文件與技術細節視為機密。並不得於任何情況下將其透露予外界單位。

5.認可測試實驗室之登錄

被認可之測試實驗室應登錄於「經認可之測試實驗室清單」。

6.測試報告之接受

由本合約簽署單位認可的測試實驗室出具之測試報告，應為所有本合約簽署單位接受。

7.驗證

(1)本合約每一簽署單位將依據被認可實驗室出具之測試報告，獨立地驗證材料與產品。

(2)本合約每一簽署單位將依據其規定驗證材料與產品所制定之收費標準，收取驗證或使用其驗證標誌之費用。

8.合作與通告之責任

DIN CERTO，BPI 及 BPS 將互相通告其如何認可測試實驗室之政策及「經認可之測試實驗室清單」之改變。

9.認可與同儕審查

(1)本合約簽署單位同意於本合約簽署兩年後，評估各簽署單位是否已具有能力依據下列認證標準提供認證，俾改善驗證計畫之公信力。認證標準可為 EN 45011『執行產品驗證機構之一般要求事項』或 ISO/IEC Guide 65『執行產品驗證機構之一般要求事項』，或 JISQ 0065『執行產品驗證機構之一般要求事項』。

(2)如本合約簽署單位任二方對於第三方是否能滿足本合約之要求產生嚴重疑慮時，應進行同儕審查。同儕審查應由提出質疑之二方各派一名稽核員執行。如質疑之事經查屬實，則同儕審查所發生之費用應由被稽核之一方負擔。若為不實，則費用應由提出質疑者負擔。

(3)如本合約任一簽署單位不能滿足本合約之要求

且經同儕審查後發現違約屬實，則此單位應採取適當措施以確保能恢復符合本合約之要求。適當措施應由被要求改善之一方提出，經提出質疑者同意後實施。

10.保密條款

(1)DIN CERTO，BPI 及 BPS 之員工與其指派之稽核員應將任何因執行測試實驗室認可與監督活動而可能獲得之資訊視為機密。

(2)除非獲得相關單位同意，所有因執行產品認可與監督活動而獲得之資訊不得透露予外界單位。

11.責任

本合約簽署單位應負責執行本合約要求。

12.其他利害相關者

DIN CERTO，BPI 及 BPS 將努力與其他利害相關組織或單位建立關係，俾鼓勵發展全球性、可比較之測試與規範。唯任何其他利害相關者需取得 DIN CERTO，BPI 及 BPS 書面同意後，始能與本合約簽署單位簽定本（或類似）合約。

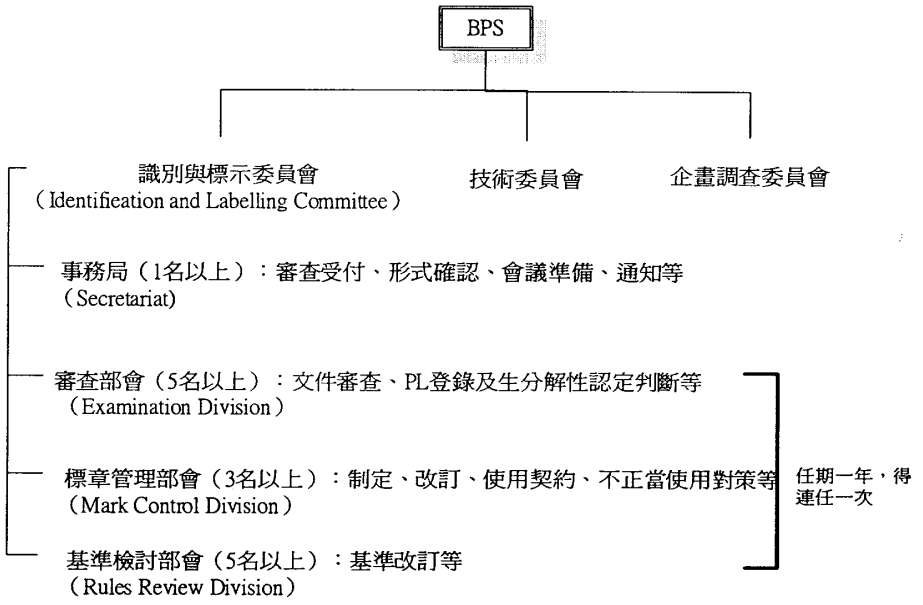
13.合約期限

本合約期限為五年，且可再持續或於合約期滿六個月前，由任一方提出撤銷通知並退出本合約。

(註：本合約是由 BPS 總經理及驗證系統委員會主席、BPI 總經理及科學委員會主席、DIN CERTO 執行長及驗證委員會主席等六人共同簽署而成)。

(二)日本生物可分解塑膠協會(BPS)之“Green Pla”標章驗證方式（資料來源 http://bpsweb.net）(詳見附錄七)

1.組織架構/機能



2.需為 BPS 會員始得申請使用 Green Pla 標章

加入 BPS 會員之申請費為日幣 100,000 圓；另年費為日幣 75,000 圓

3. Green Pla 識別與標示系統，2000 年 4 月第一版之內容：

(1)識別與標示基準

(a)申請 Green Pla 之材料或產品，其組成物（組件）需為已由本會列入正面清單中者。

(b)必須符合正面清單之規則。

(c)所有之組成物（組件）均須向本會之識別與標示委員會申報。

(d)Green Pla 之產品中必須含有 50%（重量或體積比）以上有機物。

(e)Green Pla 產品中，特殊元素之含量不得超過附表 1 所列之上限。

附表 1.產品中特殊元素含量上限

元素名稱	上限，PPM	元素名稱	上限，PPM
鎘（Cd）	0.5	硒(Se)	0.75
鉛（Pb）	50.0	鎳(Ni)	25.0
鉻（Cs）	50.0	鋅(Zn)	150.0
砷（As）	3.5	鉬(Mo)	1.0
汞（Hg）	0.5	氟(F)	100.0
銅（Cu）	37.5		

註：偵測數據須以具有足夠正確性之化學分析方法或以具有合理基礎之推估法所得到。原子吸收光譜（AA），螢光 χ 射線光譜或吸收光譜均可視為化學分析法。如係使用其他方法，請附操作方法簡述於申請書中。

(2)使用識別標章之標準

(a)識別與標示委員會將決定所有與使用 Green Pla 標章事宜。申請者須依據委員會指示申請使用 Green Pla 標章。

(b)申請者須以書面方式向委員會提出申請，通過後始得使用標章。

(c)獲標章使用許可之廠商須提供已貼有 Green

Pla 標章之產品樣本予委員會。

(d)標章使用期限為三年，期滿得申請續約。

(e)如需變換標章使用方式，須事先向委員會提出申請。

(f)已獲得標章之產品或組成物（組件、形式）有重大變更時，應立即停止使用標章。若事前提出申請變更獲准者則不在此限。

(g)廠商如對標章使用方式有疑問時，請向委員會提出要求指導。

(h)獲准使用標章之廠商應負所有責任。

(i)若廠商停止生產 Green Pla 產品或欲停止使用標章，須於停止生產日或停止使用後一個月內向委員會報告。

(j)如申請者退出本協會，則標章使用權將於退出日撤銷。

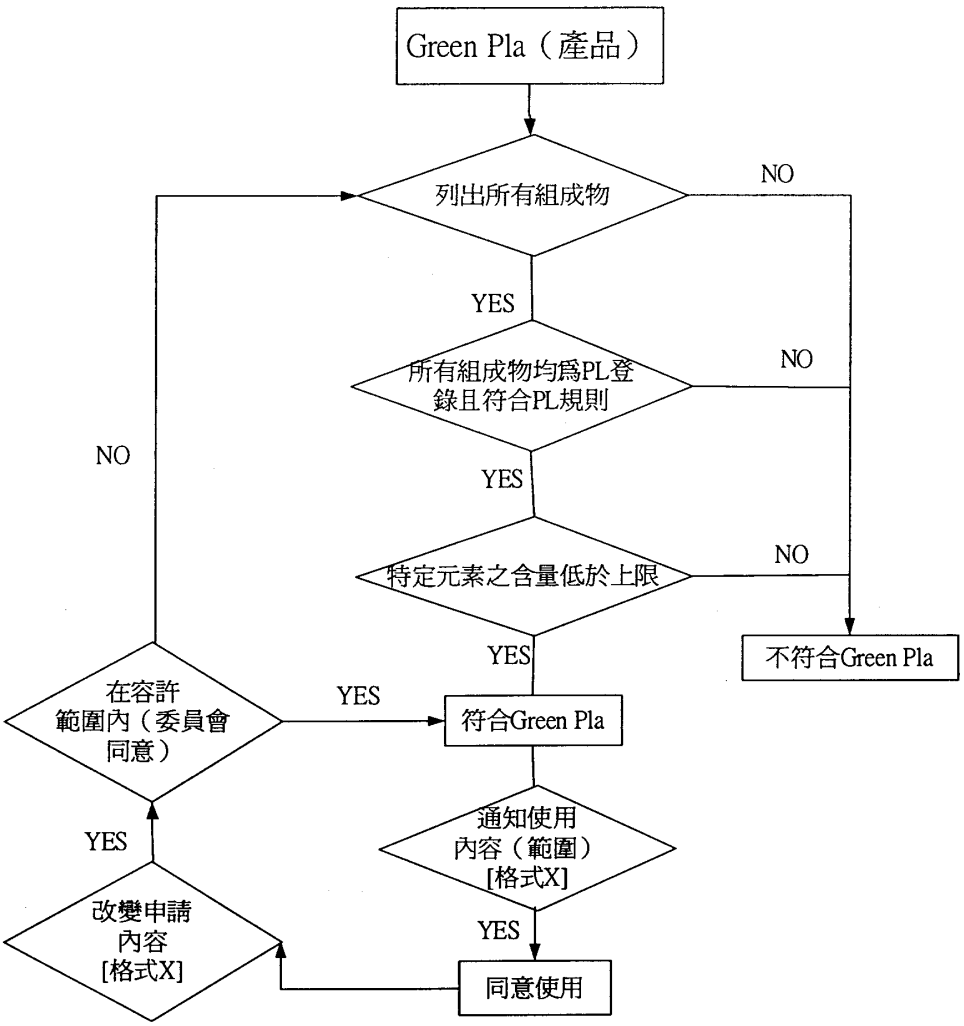
(3)申請使用標章

(a)新申請或改變標章使用方式之申請，均需依據委員會所訂基準與使用標準向委員會提出申請。

(b)一般會員，贊助會員及標章會員得依下列流程申請使用標章。

註：標章會員之權利義務僅限與 Green Pla 識別與標示系統相關者

(4)申請流程


Green Pla（產品）
列出所有組成物
NO
YES
所有組成物均爲PL登錄且符合PL規則
NO
YES
特定元素之含量低於上限
NO
YES
不符合Green Pla
在容許範圍內（委員會同意）
YES
符合Green Pla
NO
通知使用內容（範圍）[格式X]
YES
改變申請內容[格式X]
YES
同意使用

陸、考察心得與建議事項

一、心得方面

(一)我國必須加速推展生物可分解材料的四大關鍵工作－功能性、產品化、認證制度及堆肥化

此次行程中，先行拜訪日本生物可分解塑膠協會及日本有機資源協會，並參觀了赫赫有名的「日本科學未來館」；以從事生物可分解材料者的觀點來看，生物可分解材料能正式擺在未來館中陳列，意指生物可分解材料是人類未來生活的主角之一；已肯定了它的未來性，至於如何強化它的"功能性"使之產品化，以及如何達到經濟規模讓其成本逐年下降，以達到"商品化"，是生物可分解材料普及與否的二大重要關鍵。此次發現日本參與生物可分解材料產業及通過認證的廠商比往年大幅增加，可以看出日本生物可分解材料之蓬勃發展時日已不遠 。

此次本團背負一個重大的任務，就是參考歐美及日本的認證制度，作為國內認證之制度制定及推行的依據，以及日後相互承認的基礎；讓生物可分解材料得以快速在國內推動，並使目前市面上的"崩解性材料"下市，進而使劣幣驅逐良幣的現象早日自市場上消失；而要如何讓消費者容易辨識生物可分解材料乃是生物可分解材料推廣的第三關鍵。

對於高污染的「使用一次性即丟棄」之容器，應予限用並輔導業者轉型，進而鼓勵使用低污染材

質並獎勵零污染材料，以推動社會不斷地進步。而生物可分解塑膠材料即是一種近乎零污染的材料，它的零污染性來自於取之於大自然，回歸於大自然；所有生物可分解材料除了量化後的回收再利用外，堆肥化則是必走之路，而並非所有一次性的產品皆適用生物可分解材料，只有不容易回收或回收後不易再利用，甚至不具整體之環境經濟效益者才適用免洗餐具，例如：免洗餐具因生活上的需要已經無法避免使用，而國人的食物既多元化且非常油膩，頗不利於分類再生，如果和廚餘一起丟進焚化爐燃燒，則非但是資源的浪費，而且會降低焚化爐的壽命，如果使用生物可分解材料和廚餘一同進入堆肥系統，並製造成有機肥再生利用，則是最佳的作法。

目前全國 52 個禽畜堆肥場以及廢耕的農田都是堆肥的最好場所，這個工程相當浩大，必須政府有關單位大力協助方有成功希望，這也是生物可分解材料成功的第四個關健。

如將上述四大關鍵因素，結合國內外產官學研之力量及資源，必能讓生物可分解材料早日在國內萌芽發展。

(二)物競天擇、適者生存－生物可分解塑膠產品在未來將具有強大的競爭力

這次在丹佛市舉行的 BEPS 年會裡，除了原有的 PLA(聚乳酸)及化學合成材料不斷提昇改進外，

PHA 發展的比重亦令人刮目相看；好的材料每年不斷地推出與改質，熱絡了競爭的國際舞台，是世界進步最大的原動力。而競爭讓不適者淘汰，優良者出頭；競爭也讓成本加速降低，並加速提昇商品化及市場化，以造福人群。

其實合乎國際規範的生物可分解材料很多，此次年會更是百家爭鳴，一般而言，每一種生物可分解材料各有其優缺點，如何了解各種材質的特性，進而依據自己的需求，作各種不同的比例組合，以發揮最大的功能，取得最低的成本，乃是從事生物可分解材料者可發揮的舞台。

二、建議方面

我國近年來已陸續有些廠商及研發機構投入生物可分解塑膠材料的生產及研發，而政府部門對環保政策也日益重視，假以時日，未來生物可分解塑膠材料在台灣的發展，應該是可以期待的，綜觀這次參訪行程及在 BEPS 會議中所聽到之各國報告，茲提出以下幾點建議，可供我國未來生物可分解塑膠材料的發展參考：

(一)加強研發最新技術

我國研發單位應持續努力協助業界開發低成本或高性能之生物可分解塑膠材料及其應用技術，以符合未來需求及國際競爭力。

(二)儘速建立驗證機制

我國應儘快結合產、官、學、研各方資源，建立生物可分解塑膠產品之驗證機制，並與德國生物

可分解材料協會(IBAW)、美國國際生物可分解產品協會(BPI)及日本生物可分解塑膠協會(BPS)等國際知名驗證機構進行相互認證聯盟，俾利我國生物可分解塑膠產品之外銷及推展。

(三)政府積極鼓勵支持

政府應加強支持生物可分解塑膠材料之研究發展，及在政策上多加鼓勵企業發展生物可分解塑膠製品之生產，並積極輔導企業轉型，同時提升國際環保形象。

(四)建構完整堆肥體系

儘速建構堆肥化處理系統，使生物可分解塑膠製品之廢棄物處理，能充分做到良好的資源回收再利用。

附　錄　一

我國可堆肥化塑膠標章認證管理辦法

中華民國環保生物可分解材料協會

Environmentally Biodegradable Polymer Association

可堆肥化塑膠標章認證管理辦法

黃建銘博士 編撰

第一章、前言

本認證管理辦法，全名為『可堆肥化塑膠標章認證管理辦法』乃由『中華民國環保生物可分解材料協會(Environmentally Biodegradable Polymer Association, EBPA)』，以下簡稱『本協會』之理、監事會議開會審查所通過，適用於塑膠與聚合物產品的驗證與標章的使用。

本認證制度之宗旨，是以既定之可堆肥化塑膠標準來鑑定塑膠材料及其產品(包括包裝材料)，是否為『生物可分解塑膠或材料』或『可堆肥塑膠或材料』。若標示為『可堆肥塑膠或材料』之塑膠材料及其產品或包裝材料應可充分堆肥化，其生物分解之速率應與已知可堆肥化材料相當，並確保該種塑膠材料及其產品或包裝材料在堆肥過程中分解後不致於影響堆肥的品質與價值。本認證制度亦藉此教育消費者、堆肥業者及社會大眾對於『生物可分解塑膠或材料』或『可堆肥塑膠或材料』產品的正確使用觀念及回收方式。

欲使用本認證標章之產品製造商或經銷商，必須符合本協會之各項申請資格。本認證制度乃是對申請單位所提出之產品本身所含之有機成分加以評估，評估重點為該有機成分是否為生物可分解，並在一定的時間內被微生物分解為二氧化碳與水。此評估之標準係參照中國國家標準 CNS 14661『可堆肥化塑膠』標準。

若產品符合 CNS14661 之標準並恪遵本認證之條款，則該產品將獲准使用本認證制度之標章。申請者亦須遵守申請單位與本協會之間的標章使用協議之各項規定與條款。

第二章、定義

下列定義將適用於本認證制度：

1. 生物可分解塑膠(biodegradable plastic)
   由細菌、黴菌、藻類等天然微生物作用而降解之可分解塑膠。
2. 可堆肥化塑膠(compostable plastic)
   在堆肥化期間經歷生物降解過程中以與其他已知可堆肥化材料一致之速率產生二氧化碳、水、無機化合物及生質(biomass)，且未遺留可目測、可區別或有毒殘留物之塑膠。
3. 堆肥化(composting)
   控制生物可分解材料的生物分解其成分轉換為似腐植質之一種程序稱為堆肥化。有機物經好氧嗜溫與嗜熱降解製造堆肥；透過控制之生物氧化過程，經由嗜溫與嗜熱期，最終產生二氧化碳、水、礦物質與穩定的有機物(堆肥或腐植質)的一種生物可分解材料之成分轉換程序。

4. 驗證單位

驗證單位主要負責書面審查、現場稽核及採樣，以確定產品完全符合本制度之要求事項。本協會目前委託『環境與發展基金會(Environment and Development Foundation, EDF)』為本認證制度之驗證單位。

5. 申請單位

經中華民國政府許可之公司、團體或機構，致力於製造或銷售可堆肥化塑膠產品，並依照本認證制度向本協會提出認證申請的一方或實體。

6. 合格的檢測實驗室

6.1 一國內實驗室有能力完成 CNS14661 中之各項測試，該實驗室必須取得『中華民國實驗室驗證體系(Chinese National Laboratory Accreditation, CNLA)』之認定或由『經濟合作發展組織(Organization for Economic Cooperation and Development, OECD)』、『歐盟(European Union, EU)』、美國、日本、德國等組織或國家認定為『優良檢驗室操作(Good Laboratory Practices, GLP)』的實驗室對 CNS 14661 之認定。

6.2 一國、內外實驗室有能力完成 EN13432、ASTM D. 6400-99、ASTM D. 6002-96 及 DIN V 54900，該實驗室必須取得『國際實驗室驗證聯盟(International Laboratory Accreditation Cooperation, ILAC)，或由『經濟合作發展組織(Organization for Economic Cooperation and Development, OECD)』、『歐盟(European Union, EU)』、美國、日本、德國等組織或國家認定為『優良檢驗室操作(Good Laboratory Practices, GLP)』的實驗室對 EN13432、ASTM D. 6400-99、ASTM D. 6002-96 及 DIN V 54900 之認定。

7. CNS 14432

為依照中國國家標準(簡稱 CNS)通過之標準，全名為『塑膠材料在控制堆肥條件下最終好氣生物分解度及崩解性測定法—二氧化碳釋出量分析法』。CNS 14432 相對應之其他國家或國際的標準為：

ISO 14855、ASTM D. 5338、prEN 14046、DIN V 54900-2、JIS K 6953。

8. CNS 14661

為依照中國國家標準(簡稱為 CNS)通過之標準，全名為『可堆肥化塑膠』標準。本標準包含(但不僅只於)CNS 14432，全名為『塑膠材料在控制堆肥條件下最終好氣生物分解度及崩解性測定法—二氧化碳釋出量分析法』。CNS 14661 相對應之其他國家或國際的標準為：

EN 13432、ASTM D.6400-99、DIN V 54900。

9. 可堆肥認證標章：

由本協會核准，得以表示產品、產品之包裝或容器為具生物可分解性且可以堆肥化方式進行後續處理之標記。

10. 可堆肥塑膠認證證書：
由本協會核發，乃申請單位之產品已經本認證制度之技術審查委員會通過符合 CNS14661 或 EN 13432、ASTM D.6400-99、DIN V 54900 之規定，本協會針對該產品所核發之認證通過文件。
11. 標章使用協議：
乃申請單位與中華民國環保生物可分解材料協會之間的約定條款，藉此證書持有人依照各相關規定獲准於經認證之產品上使用可堆肥塑膠標章。
12. 證書持有人：
其產品按照本認證條款核可並與本協會完成標章使用協議的一方稱之。
13. 產品：
乃指做為商業用途，由塑膠、聚合物、中間物、無機物或添加劑所製成之物品、材料、成品或樹脂。
14. 無機物：
單指無機的物質與成分，在產品中所使用的非活性礦之填充物，其重量組成不得超過百分之五十(50%)。
15. 有機物：
除上列所述無機物以外的物質或成分。
16. 中間物：
成品與聚合物原料之中間狀態。
17. 添加劑：
一種材料因產品的印刷、接著、標示等製程有必要使用，如：接著劑，印刷油墨或標籤等，但其重量組成不得超過百分之一(1.0%)。
18. 產品範圍：

在與已認證核准產品比較下，所有產品必須同時符合下列兩項標準。

18.1 成份相同，包含塑膠、聚合物、中間物、無機物或添加劑。且添加劑與中間物所使用的重量組成必須不高於已認證核准產品者，則將被列入為符合此項標準。

18.2 外觀與整體尺寸必須相似。但若物料的重量組成及(或)密度小於已認證核准產品者，則將被列入為符合此項標準。

第三章、組織

為有效執行本制度，本協會下設『標章審查技術委員會』、『標章審查認證委員會』、『文書單位』，負責推動本認證制度。組織說明如下：

1. 標章審查技術委員會：
設主任委員一名，任期三年，由本協會理事長擔任。主任委員召集適當專業技術者四人擔任非常任審查委員，依個別案件由主任委員召集各非常任審查委員組成委員會。申請廠商或利害關係人不可出任本委員會之委員。

2. 標章審查認證委員會：
設主任委員一名，任期三年，由本協會理事長擔任。另設非常任委員四名，由產、官、學界公正人士擔任，依個別案件由主任委員召集各非常任委員組成委員會。申請廠商或利害關係人不可出任本委員會之委員。
3. 文書單位：
由本協會秘書處擔任。

第四章、申請要件

單位必須具備以下規定之資格，並填具與準備下列規定之書面資。

申請單位須將下列資料提交『中華民國環保生物可分解材料協會 秘書處』辦理申請驗證並繳納相關費用。
地址：台中縣大里市工業路 11 號，電話：04-24961516，傳真：04-24961513。

1. 申請單位必須為中華民國登記核准之公司或團體，應具備公司行號或商業登記或擁有核准工廠登記之生產工廠者。須檢附登記核准之營利事業登記證影本，如為製造廠商另須檢附工廠登記證影本，各三份。
2. 代理國內(外)產品之廠商，須檢附生產該產品之工廠登記証或代理權證明(須經我國駐外相關單位證明者)影印本三份。
3. 申請單位必須為中華民國環保生物可分解材料協會之團體會員，須檢附團體會員證影本三份。
4. 申請單位必須檢附使用統一發票之最近一期營業稅繳款書影本(或提出無欠稅證明)三份。
5. 申請單位須於申請日前一年內，未曾受到各級環境保護主管機關按日連續處罰、停工、停業、勒令歇業、撤銷許可證或移送刑罰等處分。應檢附經工廠所在地直轄市或縣(市)環境保護主管機關出具工廠申請日前一年內，未受按日連續處罰、停工、停業、勒令歇業、撤銷許可証或移送刑罰等環保處分證明書三份。
6. 申請單位必須檢附『可堆肥化塑膠認證申請表』(如附件一)，確實填寫以下內容：
   6.1 產品細項成分：包含所有任何塑膠、聚合物、中間物、無機物、添加劑及任何其他包含在本產品內之物料所佔比率，加總百分比應為100%。
   6.2 產品應用範圍：包含產品的用途、產品的尺寸規格。
   6.3 特殊元素成分
   6.4 產品製造方法
7. 申請單位必須由代表人簽署認同本認證制度條款。
8. 申請單位必須繳納如附件二中有關申請項目之費用，並提出繳費收據影本。
9. 申請單位必須檢附產品之代表性樣品十份。

10. 申請單位必須檢附產品於合格檢測實驗室依照 CNS 14432 或相對應之其他國家或國際的標準如：ISO 14855、ASTM D. 5338-98、prEN 14046 及 DIN V 54900-2 之檢測報告。
11. 申請單位必須檢附產品於合格檢測實驗室對產品無毒性之檢測報告，檢測之方法如：OECD Guide 202、OECD Guide 207 或 OECD Guide 208。
12. 申請單位必須檢附產品於合格檢測實驗室對產品重金屬含量之檢測報告。
13. 上列 10~12 項中所應檢附之各種書面報告，須檢附最近一年內完成之產品檢測報告，續約案則需檢附最近三年內完成之產品檢測報告。產品的成分並無改變時，檢測報告雖超過三年，仍希望能使用時，需提出製程未改變之證據，並應進行現場稽核以判定。現場稽核應由驗證單位執行。若生產廠地在國外時，可委由當地之驗證機構執行。
14. 上列 9~11 項中所應檢附之各種書面報告，應為中文或英文表示，此外，如為國外檢測單位所提供，該書面報告應經該國家公證單位公證，同時亦應經我國駐該國之單位公證。

第五章、驗證與採樣

1. 本協會文書單位於收到申請單位之申請文件後，轉交驗證單位。
2. 驗證單位將對申請文件之有效與否做驗證工作。
   2.1 申請文件有效：
   由驗證單位至申請單位之工廠或倉庫進行無預警採樣，取得之樣品送交合格之檢驗單位做產品成分分析：
   有機材質分析：
   以 FTIR(傅立葉轉換紅外光譜儀)、DSC(示差掃描量熱法)、NMR(核磁共振儀)、EA(元素分析儀) 或 TGA(熱重量法)等作有機材質必要成分分析。
   無機材質分析：
   以原子吸收光譜儀(AA)、X-射線螢光分析儀、X-射線繞射分析儀、ICP 等作無機材質必要成分分析。
   2.2 申請文件無效：
   由驗證單位退回本協會文書單位所有申請文件，文書單位將以書面通知申請單位進行補件或退件。
3. 驗證單位在取得產品之『原子吸收光譜分析』、『紅外線傳送光譜』及『X 光發射光譜』分析報告後，核對申請單位檢附之『可堆肥塑膠認證申請表』中之產品細項成分。
   3.1 成分符合：
   驗證單位至申請單位之工廠或倉庫進行現場稽核，以確定產品係由申請單位依據其自行填報之製造方法生產、分裝及販售。
   3.2 成分不符：
   驗證單位將所有文件退回文書單位，文書單位通知申請單位退件。

第六章、審查

1. 本協會所屬之標章審查技術委員會須負責認證申請案之審查。
2. 技術審查委員會之主任委員收到驗證單位驗證通過之案件後，主任委員應於一個月內組成技術審查委員會，並召開審查會議。
3. 申請單位所提出之申請通過與否，必須由四位標章審查技術委員表決，但如有爭議時，由主任委員裁決是否通過審查。
   - 3.1 通過審查：
     由標章審查技術委員會審查通過後，主任委員將通知『標章審查認證委員會』辦理『可堆肥化塑膠認證證書』(如附件四)核發程序。
   - 3.2 未通過審查：
     若標章審查技術委員會發現申請單位所提出之各項資料中有缺失時，則視為未通過審查，主任委員將通知文書單位，由文書單位於十日內以書面通知申請單位於三十日內補件，逾期以退件處理。

第七章、標準

申請認證之產品中所含之有機物質必須符合或超過 CNS 14661 或 EN 13432、ASTM D.6400-99、DIN V 54900 所列之各項標準。詳細描述如下：

1. 申請認證之產品必須依照 CNS 14432 或相對應之其他國家或國際的標準如：ISO 14855、ASTM D. 5338-98、prEN 14046 及 DIN V 54900-2 檢測時，二氧化碳的轉換率必須符合或超過以下標準：
   - 1.1 由單一性聚合物(同元聚合物或不規則共聚物)組成之產品，當與既知在堆肥環境中視為可生物分解的自然對照材料(如纖維素或澱粉)相比較。試驗期間不超過 180 天，在試驗時程終止後，60%的有機碳必須轉化為二氧化碳。
   - 1.2 由二種或二種以上聚合物(嵌段共聚物、鏈段共聚物、摻和物或添加低分子量添加物)所組成之產品，當與既知在堆肥環境中視為可生物分解的自然對照材料(如纖維素或澱粉)相比較。試驗期間不超過 180 天，在試驗時程終止後，90%的有機碳必須轉化為二氧化碳。
   - 1.3 由二種或二種以上聚合物(嵌段共聚物、鏈段共聚物、摻和物或添加低分子量添加物)所組成之產品，每種個別重量濃度超過 1%者，均須當與既知在堆肥環境中視為可生物分解的自然對照材料(如纖維素或澱粉)相比較。試驗期間不超過 180 天，在試驗時程終止後，60%的有機碳必須轉化為二氧化碳。
2. 申請認證之產品中之無機物含量不得超過百分之五十(50%)。
3. 申請認證之產品中之重金屬含量必須符合或低於本認證制度所規定之重金屬最高含量(如附件三)。
4. 審查委員會必須審查產品符合或超過 OECD Guide202 或 OECD Guide 207 或 OECD Guide 208 化學品試驗指導綱要之規定。

第八章、經驗證產品的記錄

產品經標章審查認證委員會審查通過，並核發可堆肥塑認證證書後，本協會文書單位即將該產品列入『經認證產品表』(如附件五)中，並通知申請單位。本協會文書單位會定期將『經認證產品表』的更新資料公告。

第九章、經驗證產品的延伸

為在台灣發展可堆肥化塑膠，並考量台灣之商業行為與產業情形，本協會將列入『經認證產品表』中的產品，做以下之認證延伸使用：

1. 產品是否符合或超過 CNS 14661 或 EN 13432、ASTM D.6400-99、DIN V 54900 所列之各項標準的部分。
   - 1.1 申請單位向『經認證產品表』中的廠商購買經認證之產品，僅涉及銷售而無製造時，產品可不用重新檢測，但仍需檢附產品製造廠商的產品檢測報告。同時申請單位必須提出產品的穩定來源證明文件。
   - 1.2 申請單位向『經認證產品表』中的廠商購買經認證之產品，且涉及生產時，
     - 1.2.1 產品成分均無改變，可不用重新檢測產品，但仍需檢附產品製造廠商的產品檢測報告。同時申請單位必須提出產品的穩定來源證明文件。
     - 1.2.2 產品成分有所改變，而改變的部分為有機物部分，則申請單位必須重新檢測產品後提出檢測報告。
     - 1.2.3 產品成分有所改變，而改變的部分為無機物部分，且無機物之含量不超過重量組成的 50%，可僅依據 OECD Guide 202 或 207 或 208 檢測產品之無毒性，但仍需檢附產品生產廠商的產品檢測報告。同時申請單位必須提出產品的穩定來源證明文件。
2. 所有認證延伸的申請單位，仍須接受第五章驗證與採樣的程序。

第十章、可堆肥化塑膠認證證書

1. 證書之核發

   凡申請單位之產品經標章審查技術委員會審查通過後，技術審查委員會之主任委員將通知標章審查認證委員會，標章審查認證委員會將於十日內以書面通知申請單位與本協會簽訂『標章使用協議書』(如附錄六)，表示會遵守標章使用之協議，並繳納標章使用年費(如附件一)後，標章審查認證委員會將針對產品核發給申請單位『可堆肥化塑膠認證證書』(如附錄四)。
2. 證書之內容與效力

   內容應包含產品之註冊號碼、產品名稱、申請單位、產品規格、產品應用等。申請單位若遵守本認證條款及標章使用協議時，本證書即具有效力。效力應僅止於原受認證之產品及在產品規格或應用範圍內相同之產品。

3. 證書之移轉

證書持有人惟有於資產買賣，且此資產買賣係與認證產品之製造與發展相關的情況下，得將本證書讓渡於另一方。此購買資產之個人或實體應持續本行業之經營。惟上述認證書之移轉，須在30天內，

3.1 向本協會提出移轉之書面說明；

3.2 受移轉人須向本協會以書面方式加以承諾，願遵照並接受『標章使用協議書』及本認證條款之約束，其約束範圍與原證書持有人無異。

4. 證書之期限

申請單位除了本協會依照第六章第5點『證書之提前失效』部分或『標章使用協議書』之規定，判定提早終止證書效力外，證書之正常期限各為三年。

5. 證書之延長期限

在證書期限屆滿時，申請單位得在下列情況下，要求本協會再給予一段延長的期限，但必須繳納申請延長期限之費用：

5.1 產品成分無改變時，證書持有人必須以書面方式向本協會保證，原產品成分不變，同時驗證單位必須到產品生產之工廠或倉庫進行現場稽核，以確定產品成分、生產、分裝及販售與原始的相同。

5.2 產品成分有改變時，應重新申請認證。

6. 證書之提前失效

證書之提前失效的判定，由本協會標章審查認證委員會負責執行。當本協會自行發現或他人向本協會檢舉，證書持有人有構成證書提前失效之嫌疑時，標章審查認證委員會之主任委員將召開委員會，由委員進行表決，超過半數以上的委員同意後，則判定證書提前失效。如有爭議時，由主任委員決定是否證書提前失效。

6.1 在證書失效的情況下，其『標章使用協議書』亦自動失效。

6.2 在『標章使用協議書』失效的情況下，其證書亦自動失效。

6.3 本協會有權在下列行況下立即終止證書之效力

6.3.1 證書持有人遭受到依第十一章履約調查，發現有違反本認證條款之情宜，並未在第十一章所規定的時間內改正時；

6.3.2 證書持有人遭有關之司法或行政當局發現其違反任何相關之中央及地方政府法令條款之情節時。

6.4 證書提前失效時，證書持有人不得妨礙本協會行使任何其他法律上或要求補償之權利。

6.5 證書提前失效時，本協會『標章審查認證委員會』將通知所有會員，並公佈於本協會之網站。

第十一章、證書持有人之義務

標章之適當使用與可堆肥化產品之標示

1 證書持有人應恪遵所有『標章使用協議』之約定與限制。

1.1 產品之標示應依照『標章使用協議』的規定，已認證產品之包裝應含下列各項：

1.1.1 產品之名稱與描述，以及該產品製造商或經銷商之名稱

1.1.2 標章，如附件七所示

1.1.3 附註，如有必要，證書持有人之名稱及電話

1.2 依照『標章使用協議』的規定，在下列情況下，證書持有人得以將標章使用在廣告、銷售及產品說明上：

1.2.1 上述標章使用之說明文字必須明顯易見，且緊鄰在標章附近

1.2.2 上述標章使用之說明中，須註明與產品直接關係之製造商或經銷商名稱

1.2.3 如有許多不同的產品顯示在同一廣告或產品說明資料時，應特別標示或說明經認證產品。

1.2.4 有關產品之廣告、標示、使用上之其他相關事宜，應遵守任何其他中央或地方政府法令之約束。

1.3 證書持有人為表示其參與(支持)本認證條款的目的下，且基於推廣可堆肥化塑膠製品與標章，得在廣告及行銷用途上，使用本協會之名稱。惟證書持有人不得在其文字中暗示本協會對產品在用途、品質等功能性的保證，或暗示本協會對產品符合所有任何其他認證標準的字樣。

1.4 證書持有人應按時繳納如附錄二之證書費用。

第十二章、履約調查

1. 例行性履約監督

1.1 採樣與調查

產品經本協會認證通過後，本協會得每年至少一次執行認證產品及其範圍內產品之確實性監督。為達此目的，本協會應委託驗證單位於消費市場或使用單位隨機購買 5 個經認證產品或範圍內產品的樣品，該費用將由證書持有人支付。如不可行，驗證單位得以在無預警下由生產線上取得樣品。驗證單位針對取得之樣品做以下之調查：

1.1.1 與原申請認證產品做成分比對。

1.1.2 樣品之規格與尺寸是否符合經認證產品的範圍(第十一章之規定)。

1.1.3 樣品與包裝上使用『可堆肥化塑膠標章』與本協會名稱之方式是否符合第十一章之規定。

1.1.4 廣告或產品說明上使用『可堆肥化塑膠標章』與本協會名稱之方式是否符合第十一章之規定。

1.2 判定結果

經驗證單位採樣與調查後，如證書持有人無任何違規之情形發生時，驗證單位即將所有報告與資料送交本協會標章審查認證委員會留存。但若調查結果判定有違規時，驗證單位將通知標章審查認證委員會之主任委員召集其他四位委員召開調查會議。違規之判定，必須由標章審查認證委員會四位委員進行表決，過半數以上的委員同意，則判定有違規。如有爭議時，由主任委員裁決。

1.2.1 標章審查認證委員會將在調查會議結束後一個月內以書面通知證書持有人其履約調查之判定結果與判定因素的詳細說明。

1.2.2 如第十二章 1.1.1 之調查結果被判定違規時，本協會標章審查認證委員會將立即以書面通知證書持有人證書提前失效，違規者不得提出抗議或上訴。

1.2.3 如第十二章 1.1.2、1.1.3 或 1.1.4 之調查結果被判定違規時，本協會標章審查認證委員會將立即以書面通知證書持有人於一個內以書面提出改善方案。三個月內應立即回收並銷毀違規之產品或物品，如為媒體之廣告，應立即公開澄清。以上改善如未在規定時間內完成，本協會標章審查認證委員會將立即以書面通知證書持有人證書提前失效，違規者不得提出抗議或上訴。

2. 關於第三者控訴之履約調查

2.1 第三者之控訴產生

任何第三者向本協會提出有關證書持有人或經認證產品有以下違規情形之書面控訴時，則本協會標章審查認證委員會著手進行履約調查。

2.1.1 產品在一管理精良之堆肥環境下無法進行生物分解。

2.1.2 產品在一管理精良之堆肥環境下行堆肥處理後，影響堆肥的品質或產生有毒物質。

2.1.3 產品不符 CNS 14661『可堆肥化塑膠』標準。

2.1.4 產品與原申請認證產品成分不符

2.1.5 證書持有人或產品違反其他本認證條款。

2.2 初步調查

任何第三者向本協會提出有關證書持有人或經認證產品有如第十二章 2.1.1、2.1.2、2.1.3、2.1.4 或 2.1.5 違規情形之書面控訴後，本協會標章審查認證委員會將立即著手以下項目的初步調查。

2.2.1 確認提出控訴之第三者與證書持有人無任何利益衝突。

2.2.2 要求提出控訴之第三者提供具體資料與保證金。

2.2.3 請本協會驗證單位進行採樣與相關檢測。

2.2.4 通知證書持有人此項控訴，證書持有人應對此控訴提出說明。

2.3 判定結果

標章審查認證委員會完成初步調查，並已取得驗證單位之相關樣品、報告或資料後，主任委員將召開調查會議。證書持有人或第三控訴者得列席陳述，會議終結前應離席，由四位委員進行表決。若過半數以上的委員同意，則判定有違規。如有爭議時，由主任委員裁決是否判定有違規。標章審查認證委員會將在調查會議結束後，以書面通知證書持有人其履約調查之判定結果與判定因素的詳細說明。

2.3.1 有關本章 2.1.1 之調查。控訴人應提供足以証明該堆肥之操作乃依最佳堆肥實務之說明。如有必要本協會得向具最佳堆肥管理實務之專家諮商。而上述控訴人提出之說明或經過本協會諮商後所做出之結果，將作為日後調查會議判定是否違規之參考資料。

2.3.2 產品因第十二章 2.1.1、2.1.2、2.1.3 與 2.1.4 之調查結果被判定違規時，標章審查認證委員會將立即以書面通知證書持有人證書提前失效，違規者不得提出抗議或上訴。

2.3.3 產品因第十二章 2.1.5 之調查結果被判定違規時，本協會標章審查認證委員會將立即以書面通知證書持有人於一個月內以書面提出改善方案。三個月內應立即回收並銷毀違規之產品或物料，如為媒體之廣告，應立即公開澄清。以上改善如未在規定時間內完成，本協會『標章審查認證委員會』將立即以書面通知證書持有人證書提前失效，違規者不得提出抗議或上訴。

第三者對產品提出生物分解能力或成分不符之控訴時，驗證單位將對產品的成分加以分析，分析報告將做為判定依據。有機材質分析：

以 FTIR(傅立葉轉換紅外光譜儀)、DSC(示差掃描量熱法)、NMR(核磁共振儀)、EA(元素分析儀) 或 TGA(熱重量法)等作有機材質必要成分分析等進行有機材質成分分析。

無機材質分析：

以原子吸收光譜儀、X-射線螢光分析儀、X-射線繞射分析儀等進行無機材質成分分析。

同時驗證單位得要求產品重新進行 CNS 14661 的各種檢測，如證書持有人不認同，標章審查認證委員會得以立即通知證書持有人證書提前失效。

2.4 關於第三者控訴之履約調查費用

第三者控訴之履約調查期間所發生之採樣費用、對外諮詢費用、檢測費用、手續費及其他相關調查費用應由證書持有人支付。

3. 履約調查之上訴
證書持有人可以針對履約調查之負面結果向本協會標章審查認證委員會提出上訴，同時應備齊所有上訴之資料或文件，並繳納所有上訴之費用。標章審查認證委員會將召開調查會議重新判定履約調查之結果。
4. 履約調查之結果公告
所有履約調查之結果將以書面通知本協會所有會員，並公告於本協會之網站上。

第十三章 主動撤銷

1. 申請之撤銷
申請單位得以隨時以書面方式向本協會提出其申請案之撤銷。唯上述的撤銷案中若已完成相關費用之繳納，則申請人不得在任何情況下，要求本協會退回已繳交之費用。一旦申請被撤銷，本協會將退回申請人所提交的資料。
2. 上訴之撤銷
證書持有人接受本認證條款第十二章履約調查後，判定結果為違約，證書持有人依規定得以提出向本協會標章審查認證委員會上訴，上訴期間證書持有人得隨時以書面方式向本協會提出其上訴案之撤銷。唯上述的撤銷案中若已完成相關費用之繳納，則證書持有人不得在任何情況下，要求本協會退回已繳交之費用。一旦上訴被撤銷，本協會將退回證書持有人所提交的資料。

第十四章 機密性

除申請單位標示為「機密」之文件外，一概認定為「非機密」文件。當有關申請、履約調查或上訴的進行中，本協會將在執行過程中，維護申請單位或證書持有人各項文件的機密性。在下列情況下，「機密」之文件可由本協會公開：

1. 申請認證審查之結果
2. 履約調查之結果
3. 上訴案之結果
4. 證書持有人之姓名及受認證產品之名稱
5. 申請單位所提報之測試結果
6. 標章審查技術委員會或標章審查認證委員會在案件處理過程中的記錄，包括委員對於申請案、調查案或上訴案的投票記錄
7. 其他為使社會大眾對可堆肥化塑膠標章與本認證條款產生認同的資料

第十五章 一般性條款

1. 修訂

本認證制度條款可透過本協會理監事會開會決議通過後加以修訂。所有條款之修訂內容將刊登於本協會之會訊並公佈於本協會之網站上。如修訂之條款有影響經認證產品之適用性時，證書持有人應於半年內提出符合新修訂條款的相關資料。

2. 費用

依據本認證制度條款所應繳付的費用，應由申請單位或證書持有人依據附件二所示向本協會繳納。

3. 訴訟權之放棄

申請單位或證書持有人不得對本協會提出法律行為或賠償之訴訟。上述訴訟乃指申請單位或證書持有人不滿本協會執行本認證制度條款時之決定或結果。

4. 賠償

一旦本協會因申請單位或證書持有人在本認證制度條款上之問題遭到控訴或求償，申請單位或證書持有人需補償本協會所有的損失與費用(包括律師費)，並使本協會免於受到上述任何損失。上述損失包含賠償、訴訟、損害、責任或費用，甚至包括財產損失與人員傷害。

附件一

可堆肥化塑膠認證申請表

日期：　年　月　日　　申請單號：

產品名稱：	申請單位：
負責人/代表人：	聯絡人：
地址：	電話：
	傳真：

產品細項成分

原料名稱	成分比例(WT%)	PL NO.	備註

注意事項：

1. 原則上，原料之名稱應以化學式或化學結構式表示，且應以一般性共同使用之名稱表示。
2. 詳細列出產品所有成分，各項產品成分比例的總和應為 100%。
3. PL NO.為列在經認證產品表中之原料或產品的編號。
4. 申請人於送件時須繳付文件審查費新台幣 4000 元。

特殊元素成分

元素名稱	成分(p.p.m)	元素名稱	成分(p.p.m)	元素名稱	成分(p.p.m)
鎘(Cd)		銅(Cu)		氟(F)	
鉛(Pb)		硒(Se)			
鉻(Cr)		鎳(Ni)			
砷(As)		鋅(Zn)			
汞(Hg)		鉬(Mo)			

產品應用範圍			
產品用途說明			
產品尺寸規格			
產品製造方法			
文書單位		申請單位 簽章	

附件二

可堆肥化塑膠認證費用一覽表

收費項目	所需費用（新台幣/元）
文件審查費	4,000
採樣費	5,000
檢測費(I)材質分析(建議)	10,000
檢測費(II) CNS14432(建議)	150,000
檢測費(III)OECD無毒性檢驗(建議)	50,000
現場稽核/驗證報告	16,000
追蹤查核費（第二、三年）	8,000×2
產品抽驗費（第二、三年）	15,000×2
委員會審查費	30,000
標章維護費（三年）	30,000
合計	依認證需要而定

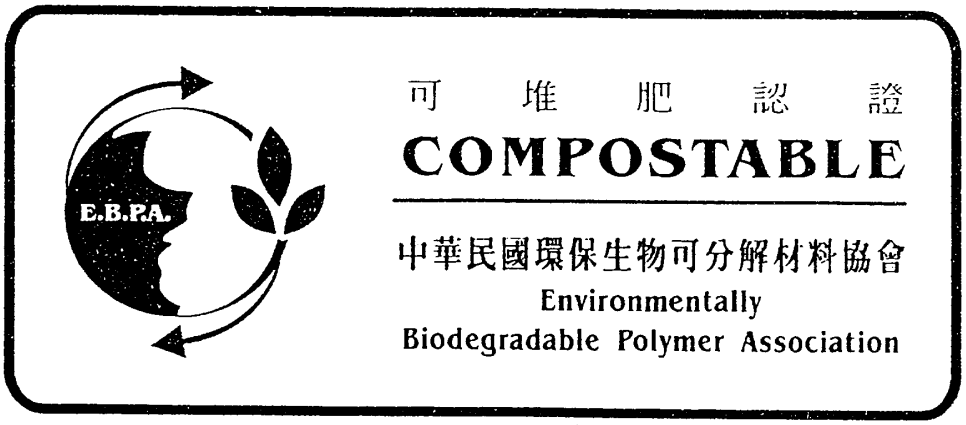
附件三 產品重金屬最低含量標準

項目 \ 地區	日本	德國	美國	台灣
Zn	≦150	≦100	≦1400	≦
Cu	≦37.5	≦23	≦750	≦
Ni	≦25	≦15	≦210	≦
Cd	≦0.5	≦0.3	≦17	≦
Pb	≦50	≦30	≦150	≦
Hg	≦0.5	≦0.3	≦8.5	≦
Cr	≦50	≦30	≦	≦
Mo	≦1	≦	≦	≦
Se	≦0.75	≦	≦50	≦
As	≦3.5	≦	≦20.5	≦
F	≦100	≦	≦	≦

相關單位：mg/kg

由技術審查委員會制定

附件七 標章圖示



中華民國環保生物可分解材料協會

可堆肥化塑膠標章證書

證書號碼：EBPA-Fxxx-xx

※※※※※※※※※※公司之※※※※※※※產品經本協會標章認證委員會審查通過，符合中國國家標準 CNLA-14461 可堆肥化塑膠規範，特頒證書以茲證明

可堆肥認證
COMPOSTABLE
中華民國環保生物可分解材料協會
Environmentally
Biodegradable Polymer Association

中華民國環保生物可分解材料協會
標章認證委員會主任委員

中華民國　　年　　月　　日

附件五 經認證產品表

序號＼項目	公司名稱	商品名稱	產品說明	標章證書編號	有效期限	標章維護現況
1	X X 企業股份有限公司					
2						
3						
4						
5						
6						
7						
8						
9						
10						

六

可堆肥化塑膠標章使用協議書

※※※股份有限公司(以下簡稱甲方)申請『可堆肥化塑膠標章』認證，經中華民國環保生物可分解材料協會(以下簡稱乙方)標章認證委員會審查通過，雙方同意訂定如下條款，以共同遵守：

一、 甲方得以將標章使用在廣告、銷售及產品說明上。

二、 甲方在『可堆肥化塑膠標章』有效使用期間，必須善盡維護本標章形象之責任，不得從事違反相關國家與地方法規、商業道德之事宜，如有違反之事實，乙方得撤銷相關之證書與標章使用權，相關之法律責任亦由甲方自行負擔。

三、 甲方擁有乙方所授予之『可堆肥化塑膠標章』使用權，有效期限三年，有效使用範圍僅限於乙方所認證之產品。在證書期限屆滿時，甲方得依「可堆肥化塑膠標章管理辦法」相關規定，要求本協會再給予一段延長的期限，但必須繳納申請延長期限之費用。

四、 甲方使用乙方授予之『可堆肥化塑膠標章』期間，如有相關違規情事，乙方得以逕行警告甲方，並限期改善，若仍無改善、或情節重大者，乙方得以逕行撤銷甲方之證書，及停止『可堆肥化塑膠標章』之使用權。

五、 甲方使用乙方授予之『可堆肥化塑膠標章』期間，有恪遵乙方所公佈之「可堆肥化塑膠標章管理辦法」相關規定之責任。

六、 甲方不得對乙方提出法律行為或賠償之訴訟。

七、 相關之條款未有完善之處，則以乙方所公佈之最新版「可堆肥化塑膠標章管理辦法」為最終之依據。

本協議書計正本二份，由雙方各執正本一份為憑。

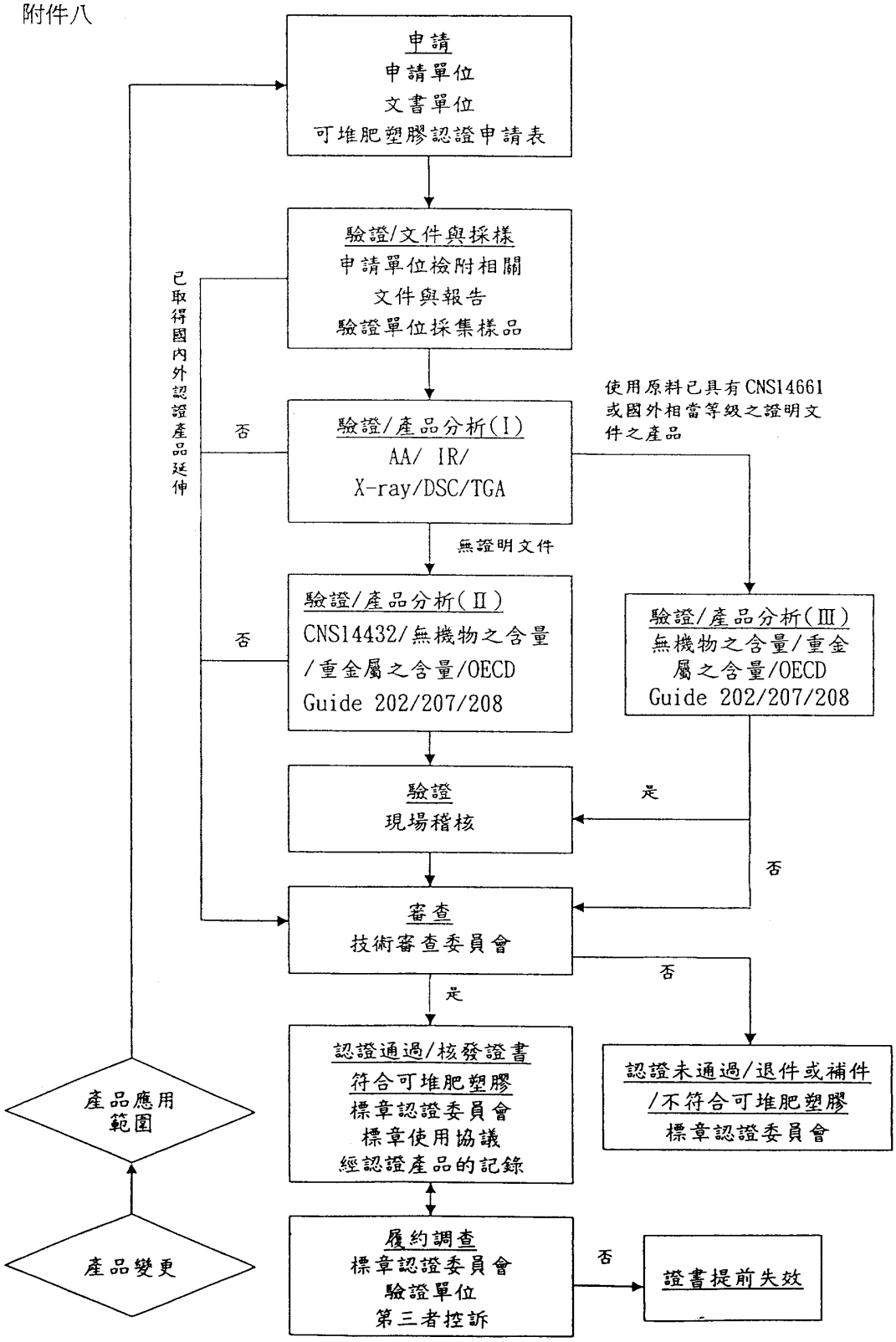
立 約 人

甲 方：
代表人：
電 話：
統一編號：

乙 方：中華民國環保生物可分解材料協會
代表人：黃 建 銘 理事長
地 址：台中縣大里市工業路11號
電 話：(04)24961516

中華民國 九十二 年 九 月 一 日

附件八


申請
申請單位
文書單位
可堆肥塑膠認證申請表
驗證/文件與採樣
申請單位檢附相關
文件與報告
驗證單位採集樣品
已取得國內外認證產品延伸
否
驗證/產品分析(I)
AA/ IR/
X-ray/DSC/TGA
使用原料已具有CNS14661
或國外相當等級之證明文
件之產品
無證明文件
驗證/產品分析(II)
CNS14432/無機物之含量
/重金屬之含量/OECD
Guide 202/207/208
否
驗證/產品分析(III)
無機物之含量/重金
屬之含量/OECD
Guide 202/207/208
驗證
現場稽核
是
否
審查
技術審查委員會
否
是
認證通過/核發證書
符合可堆肥塑膠
標章認證委員會
標章使用協議
經認證產品的記錄
認證未通過/退件或補件
/不符合可堆肥塑膠
標章認證委員會
產品應用
範圍
產品變更
履約調查
標章認證委員會
驗證單位
第三者控訴
否
證書提前失效

[Table of PL Classification]

Class		PL Category	Remarks
A		Resins	Biodegradable polymeric substances with mol.wt. of Mn 1,000 or more, including starch and polyamino acid.
B	1	Stabilizers	Including antioxidants,radical scavenger, UV absorber, etc.
	2	Surface Active Agents	Including antistatic agent, defogging agent, dispersion agent, emulsifier, etc.
	3	Slipping Agents	Including mold release agent, organic antiblocking agent, wax, rosins, etc.
	4	Inorganic Substances	Including inorganic antiblocking agent, inorganic colored filler, etc.
	5	Foaming agents	Including foaming adjuvant.
	6	Misc.(1)Org.Substances	
	7	Misc.(2) Specialty Org. Substances	
	8	Natural org. substances	Starch, cellulose, wood powder, etc
	9	Colorants	Including organic pigment, dye, masking agent, food colorant, inorganic pigment, etc
C		Other substances	Total amounts of resin (Class A) and natural organic substance (Class B-8) which may be used for them are 50.0 wt% (vol%) or more and mixed with additives (Class B)

附　錄　二

第十一屆生物可分解塑膠國際研討會論文目錄

BioEnvironmental Polymer Society 2003 Annual Meeting
Oral Presentations

Sunday August 10, 2003

12:00 – 8:00 pm Registration

1:00 – 5:00 pm Tour of the *U.S. Department of Energy's National Renewable Energy Laboratory* in Golden, Colorado.

7:00-9:00 pm Welcome Reception

Technical Program - Bioenvironmental Polymer Society 2003 Annual Meeting

Monday August 11, 2003

Microbially and Enzymatically Derived Polymers

8:00 *Efficient Production and Material Design of Microbial Polyester*
Yoshiharu Doi, RIKEN Institute, Japan.

8:30 *Coproducts of Biodiesel Production as a Source of Bacterial PHAs*
Richard Ashby, Eastern Regional Research Center, USDA, USA.

8:50 *Metabolic Carbon Flow in Biosynthesis of PHAs from Volatile Organic Acids*
Jian Yu, Hawaii National Energy Institute, U. Hawaii, USA.

9:10 *Improvement of PHA Copolymers by Co-expression of Genetically Engineered Synthesis Genes*, Christopher Nomura, RIKEN Institute, Japan.

9:30 Coffee Break

10:00 *Polymer Synthesis Employing Enzyme-Catalysis*
Richard Gross, Polytechnic University, USA.

10:30 *Microbial Polymer Synthesis in Simulated Microgravity*
Carmen Scholtz, University of Alabama at Huntsville, USA

10:50 *In Vitro Analysis of Substrate Specificity of PHAs from Evolutional Engineering*
Ken'ichiro Matsumoto, RIKEN Institute, Japan.

11:10 *Enzyme Membrane Bioreactor for Synthesis of Specialty Natural Rubber*
Dhirayos Wititsuwannakul, Mahidol University, Thailand.

11:30 Break for lunch and discussions.
Please return by 1:25 pm.

Degradable Polymers for Biological Application

1:30 *Design and Synthesis of Functionalized Polyesters and Polyethers*
Samuel J. Huang, University of Connecticut, USA.

2:00 *Controlling Biodegradable Polymers with Cyclodextrins*
Alan Tonelli, North Carolina State University, USA

2:20 *Nanospheres from Polysaccharides for Drug Delivery*
Stephen McCarthy, University of Massachusetts at Lowell, USA.

2:40 *Biomedical Application of Degradable Polymers,*
Michel Vert, University of Montpelier, France.

3:10 Coffee Break

Commercial Developments in Renewable and Degradable Polymers

3:30 *Biodegradable Polymers in Europe: Market Development and Framework Conditions*
Joeran Reske, Interseoh GMBH, Germany.

4:00 *Novel Biodegradable Blends of NODAX™ and Other Biodegradable Polymers*
Michael Satkowski, Proctor and Gamble Company, USA.

4:20 *Performance Polymers from Renewable Resources*
Robert Whitehouse, Metabolix Inc., USA

4:40 *Biodegradable Materials Opportunity Analysis*
Ken Farminer, BioPlastic Polymers and Composites, USA

5:00 *INGEO™, Cargill Dow's Polylactic Acid Fiber and Technology*
David E. Henton, Cargill-Dow LLC, USA

5:20 End of Oral Presentations

6:00 Poster Session (see titles on last and penultimate pages of this program)

Tuesday August 12, 2003

Environmentally Benign Polymer Composites

8:00 *Bio-Based Composites and Plastics from Soybeans and Natural Fibers*
Richard Wool, University of Delaware, USA

8:30 *Green Composites from Biofibers and Bacterial Bioplastics for Automotive Applications*
M. Misra, Michigan State University, USA.

8:50 *Processing and Properties of Low Cost Corn Gluten / Wood Fiber Composites*
Seiichiro Isobe, National Food Research Institute, Japan.

9:10 *Starch Biodegradation in Complex Polymeric Matrices.*
Syed Imam, Western Regional Research Center, ARS-USDA, USA

9:30 Coffee Break

10:00 *Scale-up of Film Blowing using Biodegradable Nanocomposites*
Peter Halley, University of Queensland, Australia.

10:30 *Environmentally Friendly Advanced Food Packaging with Layered Silicate Nanocomposites*, Jo Ann Ratto, U.S. Army Soldier Systems Center, USA.

10:50 *Polymerization and Formulation of Pure Kenaf Composites*
Vivak Malhotra, Southern Illinois University, USA.

11:10 *Enzyme-Retted Flax Fiber Composites with Recycled Polyethylene*
Jonn A. Foulk, Cotton Quality Research Station USDA, USA.

11:30 Break for lunch and discussions. (Please return by 1:25 pm.)

Environmentally Benign Polymer Blends

1:30 *Reactive Extrusion of Starch-Polyacrylamide Graft Copolymers*
J.L. Willet, Plant Polymer Research Unit, NCAUR, USDA-ARS, Peoria, IL, USA.

2:00 *Modification of Aliphatic Polyesters and their Reactive Blends with Starch*
Chang-Hyeon Kim, Daeduk Institute of Honam Petrochemical Corporation, Korea.

2:20 *Maleated Polylactide as an Interfacial Compatibilizer in Biocomposites*
David Plackett, Danish Polymer Center, RISOE, Denmark.

2:40 *Constitutive Analysis of the Nonlinear Rheological Behavior of Cellulosic Fiber Gels*
C. J. Carriere , NCAUR, USDA-ARS, Peoria, IL, USA

3:00 Coffee Break

Polymer Reincarnation: Recycling and Waste Management

3:30 *Solid-State Shear Pulverization: A Novel Process for Recycling and Renewables*
John Torkelson, Northwestern University, USA.

4:00 *Oxo-Biodegradable Polyethylene: A Viable Option for Plastics Waste Management*
Graham Swift, GS Polymer Consulting, USA.

4:20 *Oxidative Degradation of trans-1,4 Polyisoprene by Enzyme-Mediated Systems*
Makiko Enoki, Polymer Chemistry Laboratory, RIKEN Institute.

4:40 *Microbial Degradation of Polylactide and Silk Fibroin*
Yutaka Tokiwa, AIST, Japan.

5:00 *Use of Bench Top Fermentors for Biodegradability Studies*
Vasantha Nagarajan, Central Research & Development, DuPont, USA.

5:20 End of Oral Presentations

5:30-7:15 Business Meeting

7:30 Award Banquet

9:00 **Diner Lecture, *Earth System Engineering,*** by Murray Hitzman, Charles F. Fogarty Professor of Economic Geology, Colorado School of Mines.

Wednesday August 13, 2003

Plant Derived Polymers

8:00 *Segmented Polyurethanes from Soybean Oil*
Zoran Petrovic, Pittsburgh State University, USA.

8:30 *Structural Development in Oleate-Zein Sheets*
Graciela W. Padua, University of Illinois, USA.

8:50 *Biodegradable Behavior of Some Vegetable Oil Based Polymers*
Randal Shogren, Plant Polymer Research Units, USDA, USA.

9:10 *Formaldehyde-Free Soybean Protein-Based Adhesives*
Jeanne N. Sherra, University of Southern Mississippi, USA.

9:30 Coffee Break

Water Soluble and Other Biopolymers

10:00 *Aspartic Acid Copolymers: Sustainable and Biodegradable Polymers*
Graham Swift, Folia Inc., USA.

10:30 *Slow-Degrading Water Permeable Biopolymer Matrices*
Syed Imam, Bioproduct Chemistry and Engineering, WRRC, USDA-ARS, USA.

10:50 *Morphology, Chemistry, and Industrial Application of Starch*
Jeffery Keiser, Penford Products Company, USA

11:10 *Properties of Gels made from Starch-Polymer Blends.*
Gregory Glenn, Western Regional Research Center, USDA-ARS, USA.

11:30 Break for lunch and discussions. (Please return by 1:25 pm.)

Other Biopolymers and New Developments

1:30 *Potential of Plant Protein Polymers as Industrial Materials*
X. Susan Sun, Kansas State University, USA.

2:00 *Optimizing the Interactions between Protein and Trithiol via a Combined Approach*
Dara L. Woerdeman, Katholieke University, Belgium.

2:20 *Biodegradable Plastics as Sorbents for Toxic Chemicals*
Yukiko Matsuzawa, Toyohashi University of Technology, Japan.

2:40 *Polylactide Fundamentals and Property Modification by Blending*
John R. Dorgan, Colorado School of Mines, USA.

3:00 Closing Remarks and Meeting Adjournment

BEPS 2003 Annual Meeting
Poster Session

1. *Starch-g-Polycaprolactone Polymers by Reactive Extrusion Processing*
   Sundar Balakrishnan, Ramani Narayan

2. *Extrusion Processing of Inorganic Filled Biodegradable Polymers for Blown Film*
   Chrisina Berger, Sundar Balakrishnan, Ramani Narayan

3. *Blends Comprising Biodegradable and Non-biodegradable Synthetic Polymers*
   Girma Biresaw, Abdellatif Mohamed, and Craig J. Carriere

4. *Predictive Melt Rheology of PLAs Based on a Simple One-Point Solution Test*
   John Dorgan, Jay Janzen

5. *Functional Properties of Extruded Starch Acetate Natural Fiber Foams*
   Jinjie Guan

6. *Physical Properties of Crosslinked PLLA by Gamma-ray Radiation*
   Fengzhe Jin, Song-Hyu Hyon, Sadami Tsutsumi

7. *Modification of PLLA and PGA by Direct Copolycondensation of Lactic Acid and Glycolic Acid with other Alpha-hydroxy acids.* Sung-Il Moon, Suong-Hyu Hyon, Yoshiharu Kimura

8. *Process Engineering Principles of Production of Starch Foam Sheets and their Functional Properties.* Yogaraj Nabar, Ramani Narayan

9. *Modification of PLLA – Improvement Over the Flexibility and Degradation Rate*
   Hosei Shinoda, Takeshi Kashima, Takazo Kato, Takayuki Kuroki

10. *Autoinducers of the Quorum Sensing System Enhance PHB synthesis in* ***Pseudomonas SP 61-3.*** Kuzunori Taguchi, Tsukasa Ikeda, Junichi Kato, Yoshiharu Doi

11. *Preparation of High Molecular Weight Products by Crosslinking Protein Isolated from the Enzymatic Processing of Chromium Containing Wastes.* M.M. Taylor, W.N. Marmer, and E.M. Brown.

12. *Studies of the Complexation of Polymers and Cyclodextrins with Applications to Biodegradable/Bioadsorbable Polymers.* Alan E. Tonelli

13. *Polymerization of Functionalized Soybean Oil for Commercial Applications.* Phuong Tran, Ramani Narayan.

14. *Characterization of zein modified with a mild cross-linking agent*
    S. Kim, D. J. Sessa, J. W. Lawton

15. *Effect of Plasticizer and Agricultural Fiber on the Mechanical Properties of Starch-Pectin Cast Films.* Justin Shey, Western Regional Research Center, USDA-ARS, USA.

16. *Ligno-cellulosic Dispersed Phase in Starch-Based Thermoplastics*
Maria Inglesby, William Orts, Western Regional Research Center, USDA-ARS, USA.

17. *A study of the rheological interactions of Biomass Blended with Biodegradable Plastics.* Yi-Fan Wu, Plastics Industry Development Center,Taichung, Taiwan, R. O. C.

18. *PCL / Corn Starch / Calcium Carbonate Blends.* YuChih Kao*, Plastics Industry Development Center,Taichung, Taiwan, R. O. C..

19. *Thermally Stable Lubricants from Vegetable Oils.* Ryan Vicray[1], Dan Graiver[2], Ken Farminer[2], and Ramani Narayan[1,2] [1]Michigan State University, Department of Chemical Engineering & Materials Science, East Lansing MI 48824
[2]BioPlastic Polymers & Composites LLC, 4275 Conifer Circle, Okemos MI 48864

20. *Characterization Of Poly(Lactic Acid) (Pla) Modified By Ionomers.* Sang-il Han, T. H. Han, S. S. Im

21. *Structural Changes of Poly(tetramethylene succinate)/Polycarbonate Copolymers on Hydrolysis.* Wan Duk Lee, Min Shin, Seung Soon Im Department of Fiber & Polymer Engineering, College of Engineering, Hanyang University 17, Haengdang-dong, Seongdong-gu, Seoul, 133-791, Korea

A STUDY OF RHEOLOGICAL INTERACTION OF BIOMASS BLENDED WITH BIODEGRADABLE PLASTICS

Yi-Fan Wu, Yio-Chih Kao*, Yiau Kuei. Shiao*
Chien-Ming Huang***
*Plastics Industry Development Center,Taichung, Taiwan, R. O. C.
**Department of Chemical Engineering,Hsiu-Ping Institute of Techology,Tawan,R.O.C.

Diagrams &Tables

Table1 Different dosages of formula & melting index, which may directly effect different flow phenomenon in versatile applications. There is an inverse MI point between NO5 and NO6,which means there might be a recommended dosage if the physical property is acceptable at this flow condition.

NO.	Dosage	MI (load=1.2kg,Temp=150_)
1	50g(co-ester)	37.57–0.25
2	25g(co-ester)+25g(Corn Starch)	12.72–0.48
3	25g(co-ester)+20g(Corn Starch)+5$CaCO_3$	17.38–0.67
4	25g(co-ester)+15g(Corn Starch)+10$CaCO_3$	12.70–0.32
5	25g(co-ester)+10g(Corn Starch)+15$CaCO_3$	13.05–0.42
6	25g(co-ester)+5g(Corn Starch)+20$CaCO_3$	15–0.37

Abstract

Native starch and calcium carbonate are both biomass and easily obtained from the nature; they are usually used as additives in biodegradable polymers to evaluate an optimum of performance/cost value, which yet is not our main purpose for this research.

In this study, PLASTICODER was applied as a rheometer, and melting index for each single batch was further checked respectively.

We fortunately found that there were lots of interesting interactions between this organic/inorganic biomass blending system in biopolymers; expecting that those clues concluded below may benefit those who will be interested in the related field in the near future.

Conclusion

Blank (No1) of no biomass blended in presented a very low torque after melting at time sequence of 2.0 minutes, while the others maintained longer time and higher torque, especially for the green one (No2) which showed a good interior plasticized property by adding starch into biopolymer up to 50% or even more. When we decreased the dosage of starch and meanwhile increased that of calcium carbonate, the curves moved along green to blue one, which revealed different lubricant effect for Blank No1. Among them, the maximum torque of pink one (No4) presented a lower value then red one (No3) but prolong better torque at the end, which means the preplasticization and inner plasticization of theformer is much suitable than that of the latter.

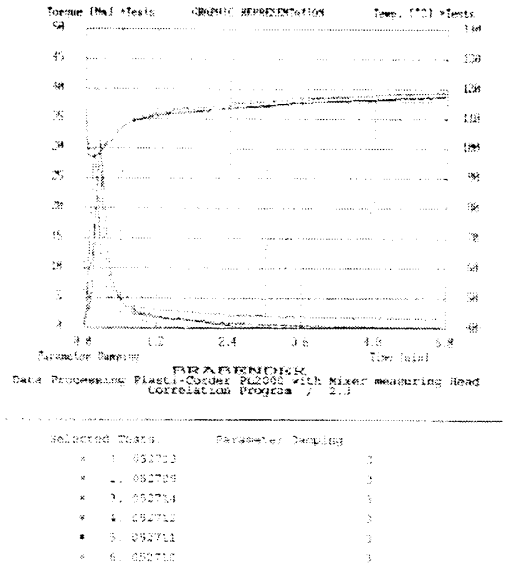


Fig 1: Different torques denote interior/exterior lubricant characteristics in this blending system.

Preparation and Characterization of PCL/ Corn Starch /Calcium Carbonate Blends

Yu-Chih Kao, Ivan Wu*, Yiau-Kuei Shiao**
*Chien-Ming Huang***
**Plastics Industry Development Center, Taichung, Taiwan, R. O. C.*
***Department of Chemical Engineering, Hsiu-Ping Institute of Techology, Taiwan, R.O.C.*

Biodegradable polymers, such as biopolymer/polymer blends have attracted interest in recent years. Biodegradable polymers can reduce the landfill area. Biopolymer, such as starch, cellulose and chitin, are cheap, biodegradable and can be blend with biodegradable polymers. Polycaprolactone (PCL) is biodegradable polyester that is widely used in blends with natural biopolymer, such as starch. In this study the biodegradability of corn starch/PCL/calcium carbonate had been investigated. We prepared six different blends and pure PCL in this study. The blends were analyzed by DSC, TGA, universal testing machine, Melting Index tester. Comparison of the blends as pressed, quenching after melting from 25□ to 200□ and melting after quenching, showed some change in the crystalline melting temperature (Tm) and the heat of fusion of the melting transition (ΔH_f). After the first melting process, the ΔH_f of pure PCL was 60.893 J/g and the Tm of PCL was 67□. But After the second melting process, the crystalline of PCL was disappeared. The incorporation of starch into PCL would keep the crystalline of PCL after second heating, the blends possessed 1/ΔH $_f$ and was decreased 20% Tm. The increasing the content of starch would decrease the value of MI (about 1/4MI). Adding calcium carbonate into PCL did not also have Tm after first heating and second heating. For PCL/starch/$CaCO_3$ blends, as the starch/$CaCO_3$ ratio was less than 1.17, Tm was disappeared after first heating. As starch/$CaCO_3$ ratio decreased, the melt index values of blends were also decreased. Significant decrease in crystallinity of PCL/starch/$CaCO_3$ blend was caused by the increased difficulty in rearranging the PCL polymer chain by incompatibility between hydrophilic starch and hydrophobic PCL. The calcium carbonate significantly hindered the forming crystalline domains of PCL because of incompatibility.

Keywords: biodegradable, Polycaprolactone, starch, crystallinity

附　錄　三

美國穀物協會日本東京辦事處活動情形

USGC Activities on Bioplastics/Biomaterials in Japan

➢ October 1992	Mission on Biodegradable Plastics from US
➢ 1994-present	Biomaterial Industry Contractor/Expert Continues to be highly regarded resource. Effective in assisting USGC in biomaterial plastics/materials market development.
➢ December 1994	Team to International Bio-based Products Expo in KS
➢ June 1995	International Conference on Biodegradable Material and Composting - Tokyo
➢ May 1997	Organic Recycling Promotional Workshop in Japan
➢ February 1998	Support Nagano Winter Olympic events for the showcase of PLA textiles
➢ February 1999	Fashion Show for the earth in USGC VEG II at Florida
➢ 1999	Support to the Japan Organic Recycling Association (JORA).
➢ Sept 6-8, 1999	Sapporo International Symposium of Bio Recycling, Composting in Japan
➢ Sept 1999	Promotional Video on Poly Lactic Acid Fabric/Textile
➢ July, 2000	Taiwan Team on Biodegradable Plastic Policy Survey Team
➢ Sept 2000	Promotional Video on PLA Film and Sheet
➢ Sept 2001	Green Chemical Survey
➢ Nov 2001	Taiwan Biodegradable Plastics Mission
➢ 2001 –present	Promotional Activity on DDGS (co-products of ethanol and biomaterials.
➢ June 2002	Team to New Uses Conference
➢ Sept 2002	Report on starch based biomaterials
➢ May 2003	DVD on PLA applications "A Legacy for the Future"

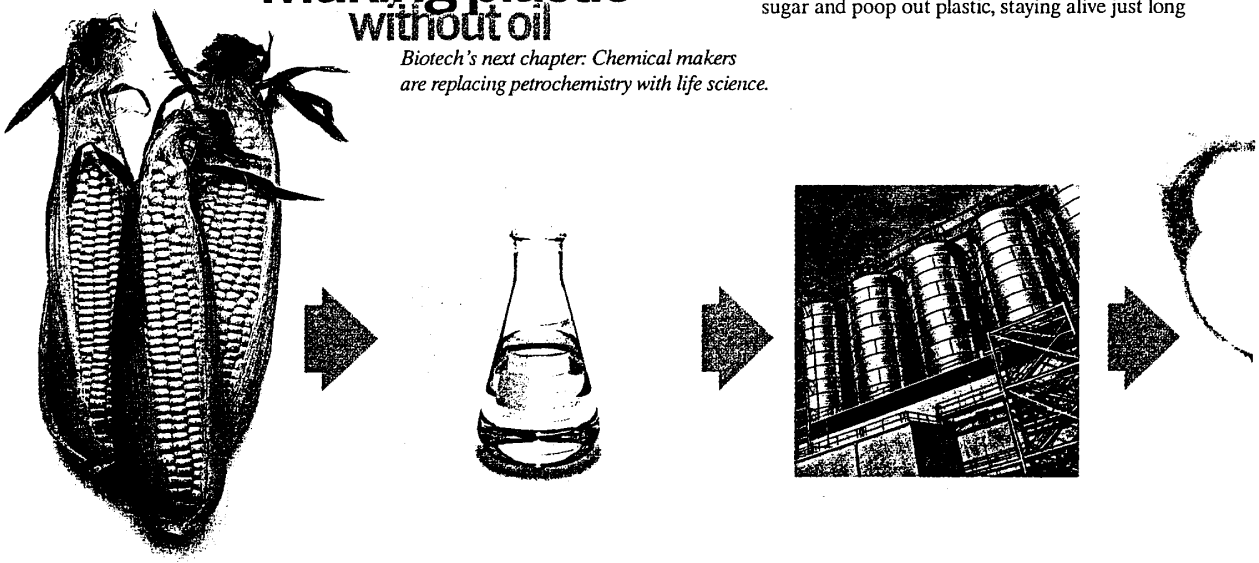
Biopl Fantast

MY DESK IS LITTERED WITH ORDINARY-SEEMING ITEMS. There's a silky white T-shirt, a square of rugged carpeting dyed beige, a long paper sleeve with a cellophane-like window for packaging a loaf of French bread, and one of those transparent, hinged pods familiar to salad-shoveling office workers who buy lunch at health-food emporiums. These items have something startling in common: The plastic in the salad pod, the fibers in the T-shirt and carpet square, and the clear stuff in the bread sleeve's window are all bioplastics, materials based not on petroleum but on corn. Just a few months ago the stuff they're made of was brewing in the guts of corn-sugar-munching bacteria in huge vats at a plant in Nebraska.

This humble collection of workaday items heralds a transformation that could reshape the industrial world and reduce our dependence on oil, the primary feedstock for almost all of the mountains of plastic we consume. Like the drugmakers before them, chemical companies large and small are awakening to the power of genetically engineered organisms to produce essential materials. "We want bugs that are engineered so that their whole purpose in life is to eat sugar and poop out plastic, staying alive just long

Making plastic without oil

Biotech's next chapter: Chemical makers are replacing petrochemistry with life science.



Corn
The lowest-cost source of sugar in North America, corn is the starting material for bioplastics.

Corn syrup
Machinery extracts dextrose from the corn and suspends it in a water solution.

Vats of bacteria
The syrup gets fed to microbes in huge fermentation vessels.

astic

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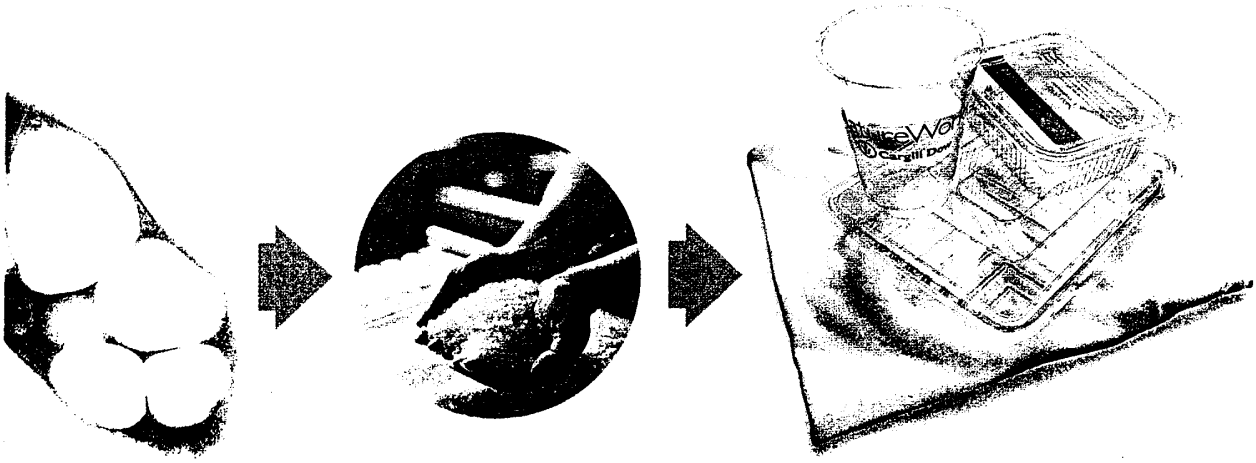
Bugs that eat sugar and poop polymers could transform industry—and cut oil use too. by Stuart F. Brown

enough to do this. And now we've got them," exults a DuPont executive. Done right, the biotech processes are showing that they can compete with petrochemicals on cost, and some of their products are even biodegradable—a feature that lends the nascent bioplastics field a powerful green allure.

The most visible symbol of this sea change in manufacturing technology is a new Cargill Dow plant that towers above the flat corn country in Blair, Neb. The joint-venture company is producing a plastic called polylactic acid, or PLA, which competes with traditional petroplastics like polyester and PET for use in packaging and clothes. Besides the stuff on my desk, fibers and films from Cargill Dow's PLA are finding early markets around the world in pillows, food and candy wrappers, and more.

Chemical giants like DuPont, as well as small, research-oriented startups like the MIT spinout Metabolix in Cambridge, Mass., are beavering away on plastics brewed up in fermenters full of living organisms and nutrient broth. While biotech chemicals account for just a smidgen of total sales today, it's a trend that could quickly add up to a very big deal, according to a recent McKinsey & Co. study. McKinsey principal Rolf Bachmann estimates that by 2010, chemical products made at least partly by biotech methods could account for $280 billion of a projected $1.4-trillion-a-year chemical market. Sales that large would displace a notable quantity of oil, freeing it up for other uses and helping keep prices down—



Plasticky gobs
Microbes convert the sugar into plastic precursors or plastic itself (the white blobs above).

Plastic pellets
After purification, the plastic gets molded into pellets for shipment to customers.

Cups, clothes ...
Manufacturers turn the pellets into everything from containers to T-shirts.

though no one can yet estimate by how much. It would also shift the source of industrial chemicals from foreign countries to farm fields nearer the markets where the end products will be consumed. That would cut transportation costs and conceivably reduce dependence on foreign oil.

Much of today's bioplastic manufacturing is really about corn. Cargill Dow's program has its roots in the late 1980s, when one of the partner firms, grain processor Cargill Inc., decided to fund R&D for new corn markets. By the mid-1990s its scientists had shown that bacteria known as *lacto bacilli* (which also live in yogurt) can be harnessed to produce lactic acid—a plastic precursor—more cheaply from corn sugar than by traditional chemical synthesis methods. (Actually the bugs would be just as happy eating cane sugar, say, or sugar derived from any abundant "biomass.") Cargill formed its joint venture with Dow Chemical Co. in 1997, and the venture broke ground for the Nebraska plant in 2000. Within three years the plant was cooking up lactic acid in 300,000-gallon stainless-steel fermenters, "polymerizing" it into PLA, and shipping the bioplastic in pellet form to customers.

Bioplastics is still in its early days, so Cargill Dow's production costs are higher than those of its petroplastics competitors. Says chief technology officer Patrick Gruber: "There's a lot of potential for future cost reductions." Yet the cost hasn't stopped early adopters, like the Boulder organic-market chain Wild Oats Markets, which uses Cargill Dow's salad trays. The PLA trays, which sell with the brand name NatureWorks molded into the bottoms, are rated "compostable"—they will break down when disposed of in a properly managed landfill. Ecologically minded Wild Oats customers are willing to pay a little more for that attribute.

The love affair with corn extends beyond Cargill Dow. At DuPont, the nation's second-largest chemical company and a major consumer of oil, CEO Chad Holliday attracted a lot of attention several years ago by declaring that the company would aim to obtain 25% of its revenues from nondepletable resources by 2010. DuPont's formidable experimental station at its headquarters in Wilmington, Del., has long been at work on the mysteries of making biotech chemicals. Now it looks as if DuPont's first polymer made by life science instead of traditional synthetic chemistry will be a corn-based fiber called Sorona.

Soft, springy stuff that competes with polyesters, Sorona is making its first appearance in women's activewear, where its ability to take bright, splashy dyes and resist the ravages of chlorine make it a natural choice for swimsuits. The fiber—which wears the chemical name 1,3 propanediol, or PDO—can be either brewed in a biotech vat or cooked up by more expensive synthetic-chemistry means. As scientists were perfecting the Sorona bioprocess in the labs, DuPont primed the textile market with chemically synthesized batches. Although the company hasn't yet committed to building a bioprocessing plant for the stuff, DuPont execs say the financial case for Sorona is strong, and a launch decision could come soon.

The case for Sorona is strong because the scientists have produced a Sorona-making superbug. Working in collaboration with metabolic engineering experts at Genencor International of Palo Alto, the DuPont team started in the early 1990s with a culture of genetically modified *E. coli* that produced tiny quantities of PDO. To achieve commercial-grade output, says senior research associate Charles Nakumura, "we had to essentially invent the organism." Normal *E. coli* devotes a whopping 67% of the sugar it consumes to obeying its natural programming, which simply says: Make more of me. Years of hard work reduced that percentage in the Sorona bugs to just 17%. The remaining 83% of the sugar's energy goes into PDO.

GREG BETZ

Green manufacturing
Metabolix's Oliver Peoples (left), James Barber (center), and Tony Sinsky have convinced jumped up *E. coli* bacteria to become mini-plastics factories.

Bacteria with a fierce work ethic can also be found at Metabolix, a biotech firm founded in 1992 atop patents licensed from nearby MIT. A few years ago Metabolix succeeded in developing a variety of jumped-up *E. coli* that can produce not just plastic precursor materials, or monomers, but the polymers themselves. Part of the trick is inserting several genes into the *E. coli*'s DNA that cause it to generate enzymes, or biocatalysts, within the cell. The enzymes first produce raw materials and then join them to form the plastic. The family of biodegradable materials made this way are called polyhydroxyalkanoates, or PHAs, and can be produced with mechanical properties varying from stiff to rubbery.

Chief scientific officer Oliver Peoples has a photomicrograph of one of his PHA-making microbes that's just astounding. The little bug's innards are utterly dominated by huge gobs of the polymer it's internally manufacturing. There's far more plastic than bug body inside one of these little devils, about 85% of its dry weight. For the past few years Metabolix has concentrated on scaling up its process from the lab, where a benchtop fermenter may contain just 20 liters of nutrient broth, to commercial-scale 60,000-liter batches. The U.S. military could be the first customer—the Pentagon is testing biodegradable PHA forks and spoons to pack with MREs, those "meals, ready-to-eat" that fuel troops in the field.

Even as the researchers are driving down the cost of bioplastics, they are grappling with another major challenge: The new materials won't get serious consideration unless they can be used with the molding and spinning and weaving machines that already populate the factories of prospective customers. But the fact that giant companies are making earnest investments shows that the idea of sustainability—of shifting from oil to raw materials that can be grown anew each year—could blossom into a very big thing. F

FEEDBACK *sbrown@fortunemail.com*

CORN, BEAKER, AND PLASTIC CUPS AND CONTAINERS: NICHOLAS EVELEIGH; BACTERIA: METABOLIX; CARGILL DOW; FACTORY AND PLASTIC PELLETS: CHRIS VOLK

Table A ID & Labeling System of Biodegradable Plastics: Comparison among Japan/Germany/EU/USA (*a)

Items \ Nations/Area	Japan ("GreenPla")	Germany ("kompostierbar")		U.S.A. ("compostable")	Comments
	–	DIN	CEN ⇒ DIN	ASTM	
1. Standard based on Chemical analysis					
•Governmental background	"GreenPla" Test Scheme"	DIN V 54900	EU 13432 ⇒ DIN EN 13432	ASTM D 6400	
•Product structure	Natural products + Resins ≧ 50wt.% or ≧ 50vol.%	Organic substances ≧ 50wt.%	LOI ≧ 50wt.%	–	LOI: Loss Of Ignition
•Characterization	(*b)	TOC TC LOI & Residues Elemental Analysis (C,H,O,S,N)	TOC gTS LOI	–	TOC: Total Organic Carbon TC: Total Carbon gTS:
•Nutritional elements of fertilizers	–	N,P,K,Mg,Ca	–	–	
•Inorganic toxic elements	Zn ≦ 150 mg/kg Cu ≦ 37.5 Ni ≦ 25 Cd ≦ 0.5 Pb ≦ 50 Hg ≦ 0.5 Cr ≦ 50 Mo ≦ 1 Se ≦ 0.75 As ≦ 3.5 F ≦ 100	Zn ≦ 100 mg/kg Cu ≦ 23 Ni ≦ 15 Cd ≦ 0.3 Pb ≦ 30 Hg ≦ 0.3 Cr ≦ 30	Zn ≦ 150 mg/kg Cu ≦ 50 Ni ≦ 25 Cd ≦ 0.5 Pb ≦ 50 Hg ≦ 0.5 Cr ≦ 50 Mo ≦ 1 Se ≦ 0.75 As ≦ 5 F ≦ 100	Zn ≦ 1,400 mg/kg Cu ≦ 750 Ni ≦ 210 Cd ≦ 17 Pb ≦ 150 Hg ≦ 8.5 Se ≦ 50 As ≦ 20.5	
•Organic toxic elements	(*c)	PCB: Not to be detected PCDD: Not to be detected PCDF: Not to be detected	–	–	PCB: Polychlorobiphenyl PCDD: Polychlorobenzodioxins PCDF: Polychlorodibenzofrans
•Environmental toxicity	•Resins: – Safety of degraded intermediates •Additives: – Food additives, or – LD_{50} ≧ 2,000 mg/kg, or – LD_{50} ≧ 300 mg/kg, and LC_{50} ≧ 100 mg/l	–	–	–	Based on Chemicals Control Law Designated substances by Food Hygiene Law Oral acute toxicity (Rat) Acute ecotoxity (Algae, Daphnia, Fish) – OECD 201, 202, 203

(*a): M.Weber@DINCERTCO: Neue Entwicklungen in der Zertifizierung von Produkten aus BAW, Biodegradable Polymers Conference, Feb.20th-21st 2001 (Wuerzburg, Germany), -BPS comments are partly added.

(*b): Not specifically regulated, but need general identification of TOC, TC, Loi including chemical structures of residual and compositional substances

(*c): Not to register on the positive list toxiclogical substances designated by Chemicals Control Law and Occupational Safety and Hygiene Law

Table B ID & Labeling System of Biodegradable Plastics: Comparison among Japan/Germany/EU/USA (*a)

Items \ Nations/Area	Japan ("GreenPla")	Germany ("kompostierbar")		U.S.A. ("compostable")	Comments
	–	DIN	CEN ⇒ DIN	ASTM	
2. Standard on Biological degradability					
•Test methods:Basic frame	"GreenPla" Test Scheme"	DIN V 54900	DIN EN 13432	ASTM D 6400	Test scheme until composting
Structure	JIS K 6950-2000 (ISO 14851)	DIN V 54900-2-V1	ISO 14851	–	Active sludge suspension method: Oxygen consumption (20-25°C)
	or		or		
	JIS K 6951-2000 (ISO 14852)	DIN V 54900-2-V2	ISO 14852	–	Active sludge suspension method: Carbon dioxide generation (20-25°C)
	or		or		
	JIS K 6953-2000 (ISO 14855)	DIN V 54900-2-V3	ISO 14855	ASTM D 6002 ASTM D 5338	High concentration compost method: Carbon dioxide generation (58±2°C)
	or				
	OECD 301C(MITI-method)				Active sludge suspension method: Oxygen consumption (Chemicals Control Law)
Period	6 months	6 months	6 months	6 months or 1 year, if C^{14} is used	
•Criteria	60% (Theoretical value)	60% (Single : Theoret. value) 90% (Compound : Theoret. value)	90% (Relative value)	60% (Single : Relative value) 90% (Compound : Relative value)	
•Objects	Compositional substances with 1% or more	Compositional substances with 1% or more	Compositional substances with 1% or more	Compositional substances with 1% or more	
•Out of objects	Compositional substances with less than 1%, but total≦5%	Compositional substances with less than 1%, but total≦3%	Compositional substances with less than 1%, but total≦5%	Compositional substances with less than 1%	

(*a): M.Weber@DINCERTCO : Neue Entwicklungen in der Zertifizierung von Produkten aus BAW, Biodegradable Polymers Conference, Feb.20th-21st 2001 (Wuerzburg, Germany) -BPS comments are partly added.

Table C ID & Labeling System of Biodegradable Plastics: Comparison among Japan/Germany/EU/USA (*a)

Items \ Nations/Area	Japan ("GreenPla")	Germany ("kompostierbar")		U.S.A. ("compostable")	Comments
	–	DIN	CEN ⇒ DIN	ASTM	
3. Standards for Compostability					
•Test methods for degradability: Basic frame		DIN V 54900	DIN EN 13432	ASTM D 6400	Test scheme until composting
Structure: Modeling	Under construction (Project for 2001)	DIN V 54900-3-V1	(Not described but need to prove)	ASTM D 6400-6.2 ASTM D 6002-7.2.1	Test under the optimized condition
		or	or		
Structure: Actual facility		DIN V 54900-3-V2	(Not described but need to prove)	–	Test under use condition of actual facility
Period		Modeling test : 12 weeks Actual facility test : 10-15 weeks	Modeling test : 12 weeks	modeling test : 5 weeks (Extendable)	
•Standard for degradability		Fragments with >2mm≦10%	Fragments with >2mm≦10%	Fragments with >2mm≦10%	(*b)
•Environmental safety		• Barley growing test : To be normal (Test method : DIN V 54900-4)		• Goby & min. 3 kinds of plant growing test : To be normal (OECD TG 208) • Worm growing test : to be normal (OECD TG 207)	
•Quality of compost		• No grain blocked for growing • No blocking for growing	• Chemical analyses : - Sp.gr., gTS, LOI, pH - contents of salts - Nutrients : N, NH4-N, P, Mg, Ca		
4. Management system					Full System managed based on Standard EN 13432
•Certification/Management •Logo •Mark	BPS/BPS GreenPla	DIN CERTCO/IBAW kompostierbar	To be officially determined ⇒	USCC/BPI compostable	AIB Vincotte (Belgium) Jaetelaitosyhdistys (Finnland)

(*a): M.Weber@DIN CERTCO : Neue Entwicklungen in der Zertifizierung von Produkten aus BAW, Biodegradable Polymers Conference, Feb.20th-21st 2001 (Wuerzburg, Germany) -BPS comments are partly added.

(*b): Ninety percent (90%) or more of fragments with 2mm is to be biodegradable.

附　錄　四

日本生物可分解塑膠協會推動認證制度情形

Friendly to Natural Environment

Biodegradable Plastics

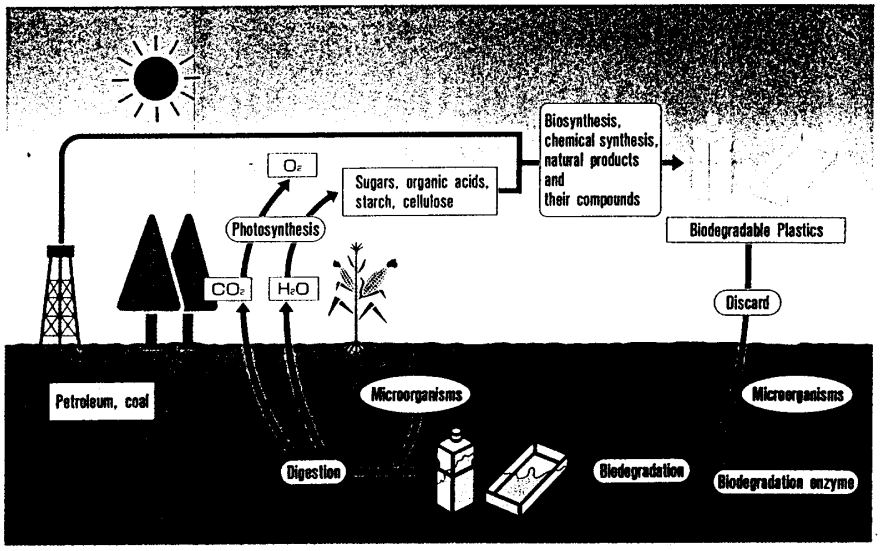
GREENPLASTICS

Biodegradable Plastics Society

75

GreenPlastics (biodegradable plastics) are:

plastics which can be used as conventional plastics, while on disposal they decompose to water and carbon dioxide by the action of microorganisms commonly existing in natural environment. They can, thus, be returned to nature.

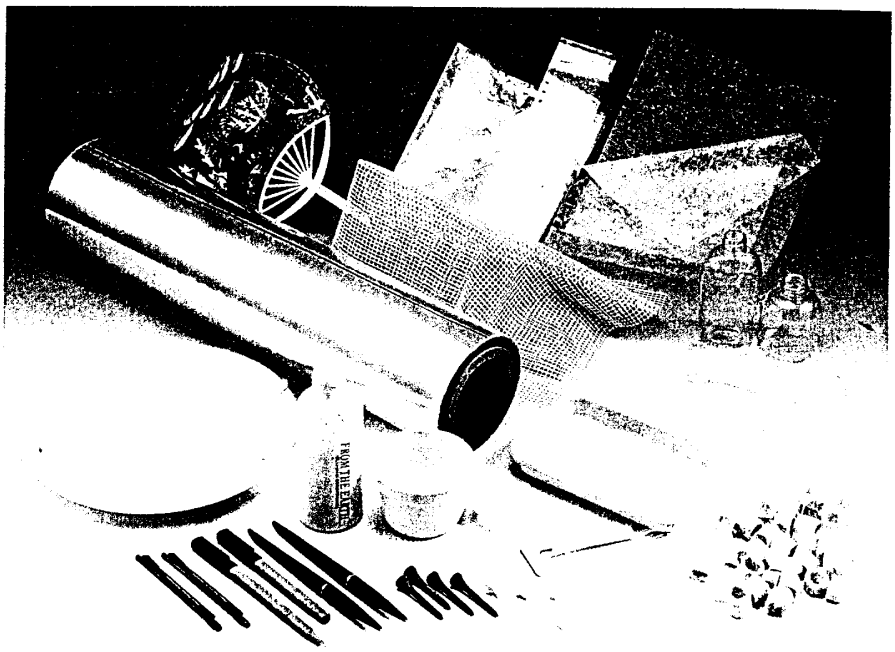


Advantages of GreenPlastics
(Biodegradable plastics)

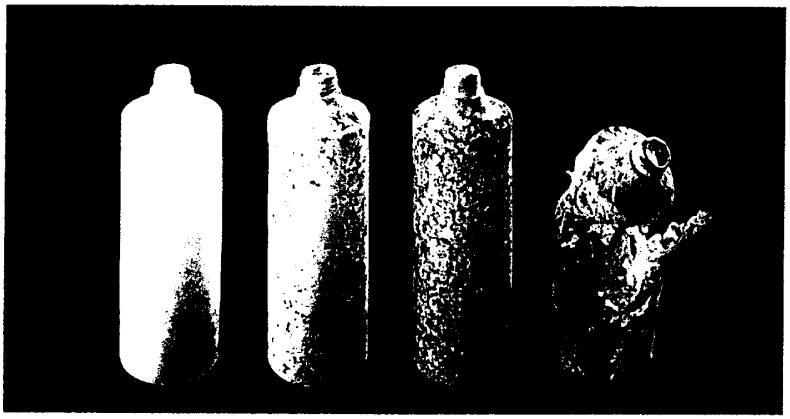
1. Biodegradable plastics ultimately decompose to water and carbon dioxide by the action of microorganisms in natural environment.
2. When put in composting facilities, they decompose quickly and do not adversely affect the quality of the compost produced.
3. When incinerated in furnaces, they do not damage the furnaces because of the low heat they generate.
4. They are expected to be used as plastic materials in natural environment and/or in areas where recycling is difficult.

Table 1. Applications of Biodegradable Plastics

Fields where biodegradable plastics can be used in natural environment	
Agricultural and fishery materials	Mulching films, pots for transplanting, and fishing lines and nets
Civil engineering and construction materials	Heat Insulators and form wares, retaining walls or bags used in civil engineering in remote areas such as mountain and sea where recovery is difficult. Protective sheets and nets for tree planting in deserts to prevent irrigation water from evaporating
Leisure goods	Golf tees and disposable goods used in fishing, marine sports and mountain climbing
Fields where recovery and reuse are difficult and where composting of organic waste is effective	
Food packaging	Trays for perishables, packages for instant and fast foods
Hygienic product	Diapers, sanitary napkins
Miscellaneous	Pen cases, disposal razors, tooth brushes, cups, trashbags and cushions
Fields with specific features	
Slow release	Material for drug, fertilizers, agrochemicals
Water retention	Material for tree planting in deserts
Medical use	Suture threads, bone fixation, films, non-woven fabrics
Low oxygen permeability	Food packaging and inner coating of cartons for liquids
Low melting temperature	Adhesives for packaging and book-binding and bags



Products of biodegradable plastics (GreenPlastics)



Biodegradation of bottle in leaves compost

Table 2. Biodegradable Plastics

Category	Generic name	Trade Name
Bacterial Polymer	Poly 3-hydroxybutyrate/valerate	Biopol
	Poly 3-hydroxybutyrate	Biogreen
	Bacterial Cellulose	———
	Polysaccharide	Cardoran, Pulluran
Synthetic Polymer	Polyamino acid	———
	Polybutylene succinate	Bionolle 1000
	Polybutylene succinate/adipate	Bionolle 3000
	Polycaprolactone	CelGreen P-H, Tone
	Polyestercarbonate	———
	Polyethylene succinate	Lunare SE
	Polylactic acid	EcoPLA, Lacea, Lacty
	Polylactic acid polyester	———
	Polyvinyl alcohol	Poval
Use of Natural Polymer	Starch, PCL, PVA	Mater-Bi, Novon
	Cellulose acetate	Celgreen P-CA, Lunare ZT
	Kitosan, cellulose	Doron CC
	Starch	Eco-Ware, Ever Corn, Eco Foam

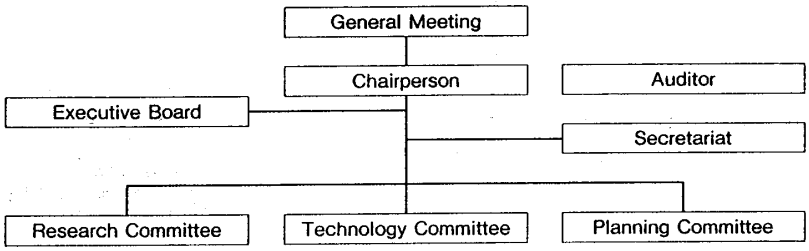
Biodegradable Plastics Society

Biodegradable Plastics Society (BPS) was organized in October, 1989. The main purpose of the Society is to establish technology of biodegradable plastics (BDP) and to lead extensive, commercial use of such plastics.

BPS is engaged in various activities such as

- Development of evaluation methods of BDP and their standardization
- Environmental labelling
- General survey of trends in plastics
- Gathering and analysis of BDP-related information
- Exchange of information with institutions similar to BPS
- Public relations
- Holding of BDP-related lectures and symposia, etc.

Organization



Biodegradable Plastics Society
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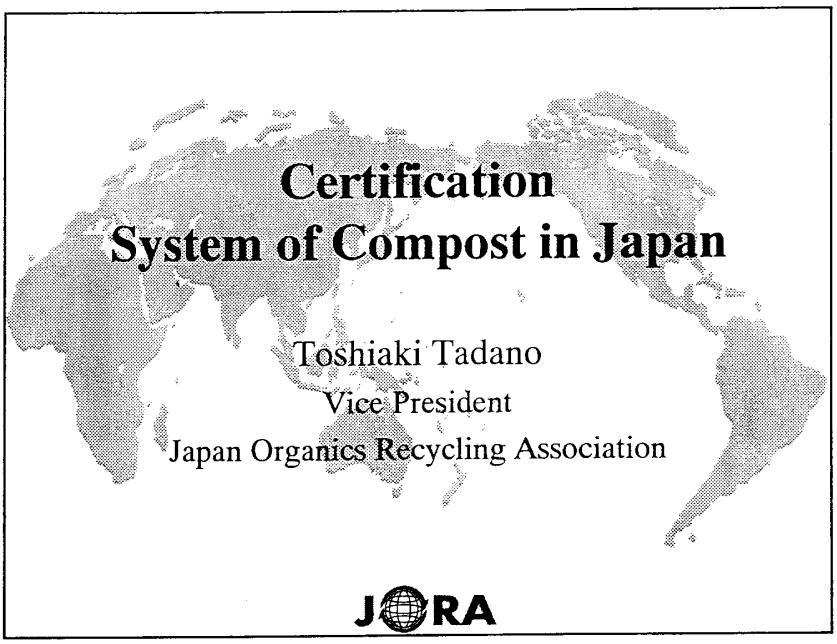
TEL: +81-3-5541-2731 FAX: +81-3-5541-2737

附　錄　五

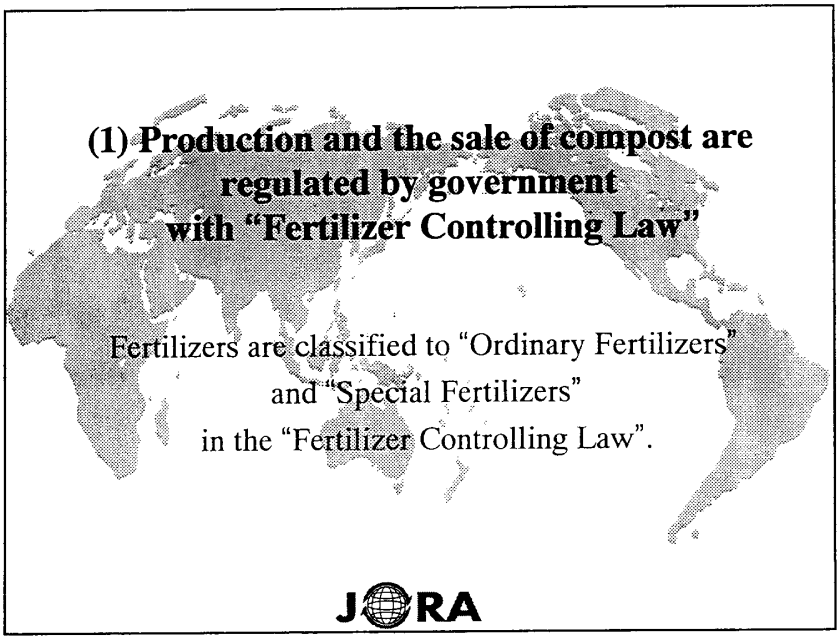
日本有機資源協會推廣堆肥認證情形



Certification System of Compost in Japan

Toshiaki Tadano
Vice President
Japan Organics Recycling Association

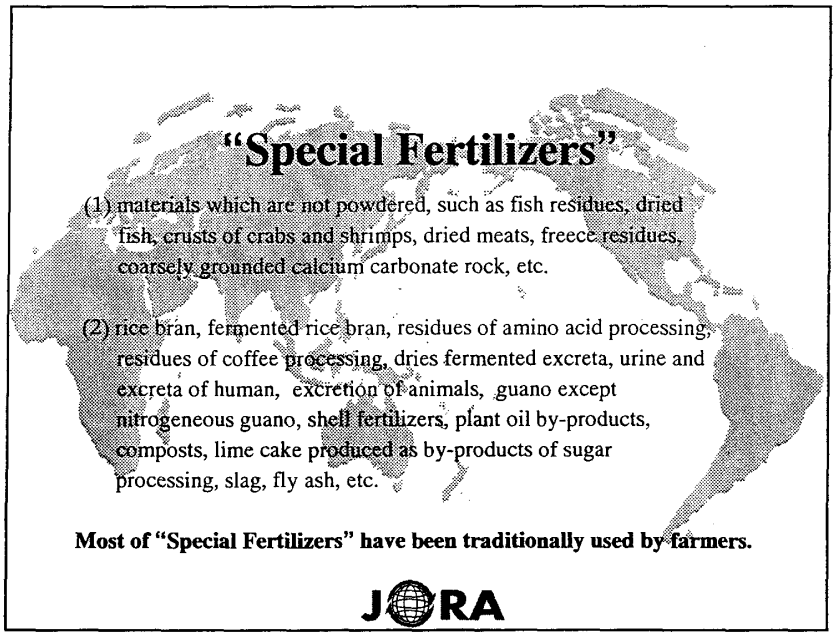
JORA



(1) Production and the sale of compost are regulated by government with "Fertilizer Controlling Law"

Fertilizers are classified to "Ordinary Fertilizers" and "Special Fertilizers" in the "Fertilizer Controlling Law".

JORA



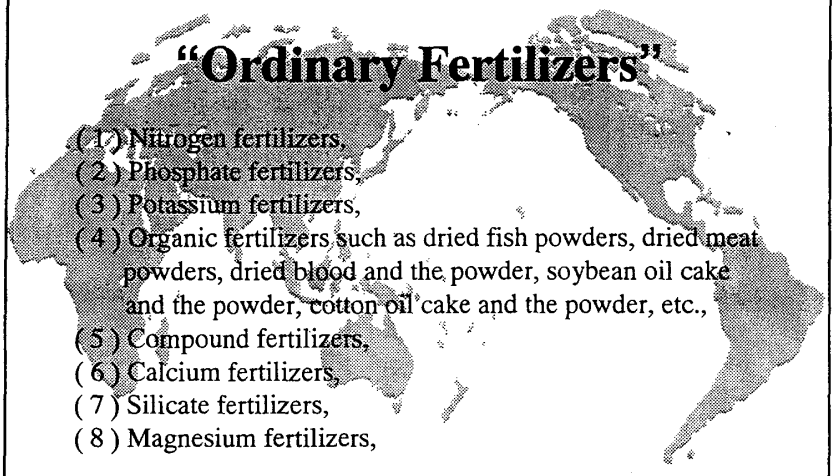
"Special Fertilizers"

(1) materials which are not powdered, such as fish residues, dried fish, crusts of crabs and shrimps, dried meats, freece residues, coarsely grounded calcium carbonate rock, etc.

(2) rice bran, fermented rice bran, residues of amino acid processing, residues of coffee processing, dries fermented excreta, urine and excreta of human, excretion of animals, guano except nitrogeneous guano, shell fertilizers, plant oil by-products, composts, lime cake produced as by-products of sugar processing, slag, fly ash, etc.

Most of "Special Fertilizers" have been traditionally used by farmers.

JORA



"Ordinary Fertilizers"

(1) Nitrogen fertilizers,
(2) Phosphate fertilizers,
(3) Potassium fertilizers,
(4) Organic fertilizers such as dried fish powders, dried meat powders, dried blood and the powder, soybean oil cake and the powder, cotton oil cake and the powder, etc.,
(5) Compound fertilizers,
(6) Calcium fertilizers,
(7) Silicate fertilizers,
(8) Magnesium fertilizers,

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"Ordinary Fertilizers"

(9) Manganese fertilizers,
(10) Boron fertilizers,
(11) compound fertilizers containing trace elements,
(12) Sludge fertilizers such as sewage sludge fertilizers produced from final treatment of sewerage wastes, industrial sludge fertilizers, mixed sludge fertilizers, burned sludge fertilizers, fermented sludge fertilizers, and fermented fishery by-product fertilizers,
(13) Fertilizers containing agricultural chemicals and others.

JORA

In this classification, various kinds of composts are ranked in "Special Fertilizers".

Composts produced from sludge such as sewage sludge, industrially produced sludge, fishery by-products and other sludge can not be called as compost even if these sludge are well fermented.
It is called as "Designated Ordinary Fertilizer".

This new regulation was decided and noticed on February of this year and enforced from 1 July.

The revision of "Fertilizer Controlling Law" was due to the fact that these sludge have a possibility containing a high level of harmful substances such as toxic heavy metals and toxic organic compounds.

JORA

(2) Regulation and Certification Systems for Sludge Fertilizers Belonging to "Ordinary Fertilizers" and Compost Belonging to "Special Fertilizers"

Regulation for "Ordinary Fertilizers" is more strict than that for "Special Fertilizers".

JORA

1-1) Regulation for sludge fertilizers belonging to "Ordinary Fertilizers" described in "Fertilizer Controlling Law"

① Allowable maximum content of harmful heavy metals in sludge fertilizers

Heavy metal	Max.content (ppm)
As	50
Cd	5
Hg	2
Ni	300
Cr	500
Pb	100

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② Allowable maximum content of harmful heavy metals and organic compounds contained in material sludge used for production of fertilizers

Heavy metals and organic compounds	Allowable Max. Content (mg/L)
Alkyl Hg compounds	not detected
Hg or Hg compounds	Hg＜0.005 / test solution
Cd or Cd compounds	Cd＜0.3 / test solution
Pb or Pb compounds	Pb＜0.3 / test solution
Organic phosphorus compounds	＜1 / test solution
Cr^{6+} compounds	Cr^{6+}＜1.5/ test solution
As or As compounds	As＜0.3/ test solution
CN compounds	CN＜1/ test solution
Polychlorobiphenil	＜0.003/ test solution

JORA

② Allowable maximum content of harmful heavy metals and organic compounds contained in material sludge used for production of fertilizers

Heavy metals and organic compounds	Allowable Max. Content (mg/L)
Trichloroethylene	＜0.3/ test solution
Tetrachloroethylene	＜0.1/ test solution
Dichloromethane	＜0.2/ test solution
Tetrachlorocarbon	＜0.02/ test solution
1.2-dichloroethane	＜0.04/ test solution
1.1-dichloroethylene	＜0.2/ test solution
Cis-1.2- dichloroethylene	＜0.4/ test solution
1.1.1-Trichloroethane	＜3/ test solution
1.1.2- Trichloroethane	＜0.06/ test solution

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② Allowable maximum content of harmful heavy metals and organic compounds contained in material sludge used for production of fertilizers

Heavy metals and organic compounds	Allowable Max. Content (mg/L)
1.3-Dichloropropene	<0.02/ test solution
1.3-Dichlorotetramethyltyuramsufide	<0.06/ test solution
2-Chloro-4.6-bis(ethylamino)-s-triazin	<0.03/ test solution
s-4-Chlorobenzyl= NN-diethylthiocarbamate	<0.2/ test solution
Benzene	<0.1/ test solution
Se or Se compounds	Se<0.3/ test solution
Dioxin derivatives	<3ng/ test solution

③ Plant growth is not disturbed when a pot experiment is conducted.

JORA

1-2) Certification System of sludge fertilizers belonging to "Ordinary Fertilizers" described in "Fertilizer Controlling Law"

① Persons who are going to produce sludge fertilizers have to apply registration to Minister of Agriculture, Forestry and Fishery and get the permission.

In this application, following items have to be written;

(1) Name and address of applicant.
(2) Kind of fertilizer and fertilizer name.
(3) Maximum content of harmful heavy metals in the fertilizer.
(4) Name of factory and address.
(5) Address of storage facility.

JORA

① Persons who are going to produce sludge fertilizers have to apply registration to Minister of Agriculture, Forestry and Fishery and get the permission.
In this application, following items have to be written;
(6) Data on plant growth experiment.
(7) Kind of crop plants to which sludge fertilizer is applied.
(8) Application method.
(9) Data on residual effect of potentially harmful substances on the plant growth in a plant cultivation experiment.
(10) Other necessary items which act of Department of Agriculture, Forestry and Fishery designates.

JORA

② When registration of a sludge fertilizer is applied to Minister of Agriculture, Forestry and Fishery, the Minister has to make a Inspection Center of Fertilizers and Feeds inspect the applied fertilizer. And when the applied fertilizer is confirmed to satisfy the regulation, the Minister has to register the applied fertilizer. When the sludge fertilizer at the usually used amount and application methods has a harmful effect on the growth of crop plants tested, the application for registration is rejected.

③ Inspecting items, inspection method, and other items required for inspection are designated by the act of Department of Agriculture, Forestry and Fishery.

JORA

④ When the applied fertilizer is registered, Minister of Agriculture, Forestry and Fishery has to deliver to applicant a registration form on which following items are written.

(1) Registration No. and date of registration.
(2) Valid duration of registration.
(3) Name and address of applicant.
(4) Kind of fertilizer and the name
(5) Maximum content of harmful heavy metals.
(6) Kind of crop plants to which the fertilizer is applied.
(7) Application method of fertilizer.

JORA

⑤ Valid duration of registration for the applied sludge fertilizer is three years. The valid duration is able to be renewed by the reapplication.

⑥ When application of designated ordinary fertilizer is accepted, Minister of Agriculture, Forestry and Fishery has to provide time of application, application method and other necessary items which persons, who apply the fertilizers, have to follow. The designated ordinary fertilizer should not be used with the methods different from the above provided method.

JORA

⑦ When producer produces sludge fertilizer, he has to attach producer certificate, on which the following items are written, on the surface of container or bag of sludge fertilizer.

(1) Letter of producer certificate.
(2) Kind of fertilizer.
(3) Maximum content of harmful heavy metals.
(4) Name of producer and address.
(5) Year and month produced.
(6) Name of factory and address.
(7) Net weight.

JORA

⑦ When producer produces sludge fertilizer, he has to attach producer certificate, on which the following items are written, on the surface of container or bag of sludge fertilizer.

(8) Registration No.
(9) Kind of crop plants admitted and application method.
(10) When foreign materials are mixed, name of the foreign materials and the mixed rate.
(11) Other items designated by act of Dept. of Agriculture, Forestry and Fishery.

JORA

2) Certification system for composts belonging to "Special Fertilizers" described in "Fertilizer Controlling Law"

① Persons who are going to produce composts for business have to notify the following items to the governor of prefecture, where his composting factory is located, by two weeks before starting compost production.

(1) Name and address of applicant.
(2) Name of compost.
(3) Name of composting factory and address.
(4) Address of storage facility.

JORA

2) Certification system for composts belonging to "Special Fertilizers" described in "Fertilizer Controlling Law"

② When notified items are changed, the compost producer has to notify it within two weeks to governor of prefecture to whom he notified at the starting time. When compost production is stopped, the compost producer has to notify it in the same way.

JORA

2) Certification system for composts belonging to "Special Fertilizers" described in "Fertilizer Controlling Law"

③ Minister of Agriculture, Forestry and Fishery designate the following items to be attached on the surface of container or bags of compost when users of compost are difficult to discriminate of the quality and when it is estimated to be necessary to discriminate it.
In this case, Minister notice it to the public.

(1) Items to be attached on the surface of containers such as content of main nutrients, raw materials, and others related to the quality of compost.

(2) Items which compost producers or dealers have to follow for attachment of items relating to the quality of compost.

JORA

2) Certification system for composts belonging to "Special Fertilizers" described in "Fertilizer Controlling Law"

④ When compost producers and dealers do not follow the above-written designation of Ministry of Agriculture, Forestry and Fishery, he is able to order them to follow the designation.

JORA

(2) Regulation and Certification Systems for Sludge Fertilizers Belonging to "Ordinary Fertilizers" and Compost Belonging to "Special Fertilizers"

Regulation for "Ordinary Fertilizers" is more strict than that for "Special Fertilizers" .

JORA

1-1) Regulation for sludge fertilizers belonging to "Ordinary Fertilizers" described in "Fertilizer Controlling Law"

① Allowable maximum content of harmful heavy metals in sludge fertilizers

Heavy metal	Max.content (ppm)
As	50
Cd	5
Hg	2
Ni	300
Cr	500
Pb	100

JORA

② Allowable maximum content of harmful heavy metals and organic compounds contained in material sludge used for production of fertilizers

Heavy metals and organic compounds	Allowable Max. Content (mg/L)
Alkyl Hg compounds	not detected
Hg or Hg compounds	Hg＜0.005 / test solution
Cd or Cd compounds	Cd＜0.3 / test solution
Pb or Pb compounds	Pb＜0.3 / test solution
Organic phosphorus compounds	＜1 / test solution
Cr^{6+} compounds	Cr^{6+}＜1.5/ test solution
As or As compounds	As＜0.3/ test solution
CN compounds	CN＜1/ test solution
Polychlorobiphenil	＜0.003/ test solution

JORA

② Allowable maximum content of harmful heavy metals and organic compounds contained in material sludge used for production of fertilizers

Heavy metals and organic compounds	Allowable Max. Content (mg/L)
Trichloroethylene	＜0.3/ test solution
Tetrachloroethylene	＜0.1/ test solution
Dichloromethane	＜0.2/ test solution
Tetrachlorocarbon	＜0.02/ test solution
1.2-dichloroethane	＜0.04/ test solution
1.1-dichloroethylene	＜0.2/ test solution
Cis-1.2- dichloroethylene	＜0.4/ test solution
1.1.1-Trichloroethane	＜3/ test solution
1.1.2- Trichloroethane	＜0.06/ test solution

JORA

① Persons who are going to produce sludge fertilizers have to apply registration to Minister of Agriculture, Forestry and Fishery and get the permission.
In this application, following items have to be written;
(6) Data on plant growth experiment.
(7) Kind of crop plants to which sludge fertilizer is applied.
(8) Application method.
(9) Data on residual effect of potentially harmful substances on the plant growth in a plant cultivation experiment.
(10) Other necessary items which act of Department of Agriculture, Forestry and Fishery designates.

JORA

② When registration of a sludge fertilizer is applied to Minister of Agriculture, Forestry and Fishery, the Minister has to make a Inspection Center of Fertilizers and Feeds inspect the applied fertilizer. And when the applied fertilizer is confirmed to satisfy the regulation, the Minister has to register the applied fertilizer. When the sludge fertilizer at the usually used amount and application methods has a harmful effect on the growth of crop plants tested, the application for registration is rejected.

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JORA

⑤ Valid duration of registration for the applied sludge fertilizer is three years. The valid duration is able to be renewed by the reapplication.

⑥ When application of designated ordinary fertilizer is accepted, Minister of Agriculture, Forestry and Fishery has to provide time of application, application method and other necessary items which persons, who apply the fertilizers, have to follow. The designated ordinary fertilizer should not be used with the methods different from the above provided method.

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JORA

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JORA

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JORA

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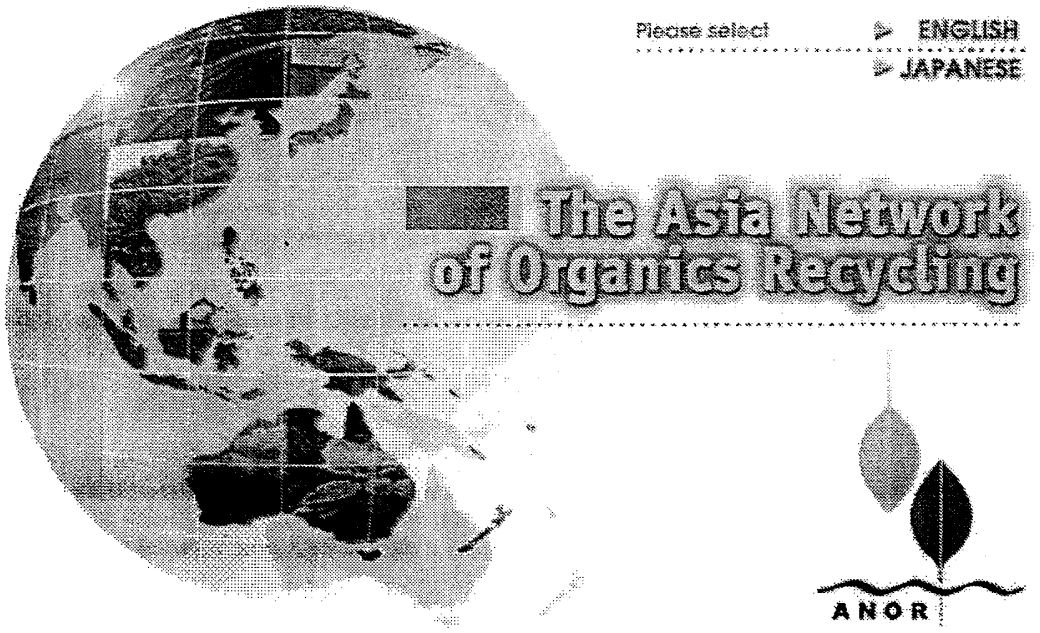
④ When compost producers and dealers do not follow the above-written designation of Ministry of Agriculture, Forestry and Fishery, he is able to order them to follow the designation.

JORA


Please select
ENGLISH
JAPANESE
The Asia Network
of Organics Recycling
ANOR
designed by Ms. Carolyn Brooks
02122
→Go JORA Site mail:hq@jora.jp

The Asia Network of Organics Recycling

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Asia Network of Organics Recycling (ANOR)
Established: June 24, 2002

AIM

1.Humans must prevent the deterioration of Earth's environment and conserve Earth as a beautiful planet with clean air, water and land, and as a planet rich in various resources. Now is the time to improve social and economic systems from those of mass production, mass consumption and mass disposal to those of material recycling, and to reduce environmental burden of waste disposal.

2.The Network shall aim to contribute to the preservation of the Earth's environment, the creation of a sustainable society and the prosperity of the people by reducing organic waste and promoting maximum diversion of organic materials from landfill and incineration to utilization as organic resources.

ACTIVITIES

1.With regard to the present situation and future challenges of organics recycling and environmental conservation activities, the Network shall exchange information and opinions based on science among members, deepen mutual understanding to develop friendship, and promote the recycling of organic resources.

2.The Network shall facilitate support and cooperation among members in promoting the awareness of and developing human resources for organic resource recycling.

3.The Network shall set standards for the smooth distribution of products made from recycled resources in the region and develop these standards in stages into international standards.

4.For the smooth promotion of the activities described above, the Network shall strengthen its links to and cooperation with organizations engaged in similar activities in other areas, such as Europe and the United States.

5.The Network shall conduct other activities required for the achievement of its aim.

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RULES

[Rules of the Asia Network of Organics Recycling]

・・・Effective as of June 24, 2002・・・

●Article 1. Name

The organization shall be named the Asia Network of Organics Recycling (ANOR).

●Article 2. Definition

1. Organics: Food waste, human and animal excreta, sludge, agricultural and forestry waste, food processing waste, and other biological waste which contain usable constituents.
2. Recycling: Any human activities which involve the conversion of organics to valuable products such as fertilizer, animal feed, heat and energy, etc., and the efficient use of the products to reduce environmental burdens of organics waste.

●Article 3. Aim

1. Humans must prevent the deterioration of Earth's environment and conserve Earth as a beautiful planet with clean air, water and land, and as a planet rich in various resources. Now is the time to improve social and economic systems from those of mass production, mass consumption and mass disposal to those of material recycling, and to reduce environmental burden of waste disposal.
2. The Network shall aim to contribute to the preservation of the Earth's environment, the creation of a sustainable society and the prosperity of the people by reducing organic waste and promoting maximum diversion of organic materials from landfill and incineration to utilization as organic resources.

●Article 4. Membership

1. Network members shall be organizations involved in policy-making, implementation, education, and promotion of organic recycling, including government agencies, institute academic societies, associations and other organizations located in Asian areas including Australia and New Zealand.
2. Members shall be those who approve of the rules of the Network, apply for membership, and are admitted by the Steering Committee as set forth in Article 7.
3. Each member shall notify the Steering Committee of the name and title of the persons within it's organization who are responsible for ANOR activities and designate a representative to the Steering Committee in advance of a General Meetings of the Network and other occasions requiring the attendance of representatives.

●Article 5. Activities

The Network shall conduct the following activities to attain its aim set forth in Article 3. 1. With regard to the present situation and future challenges of organics recycling and environmental conservation activities, the Network shall exchange information and opinions based on science among members, deepen mutual understanding to develop friendship, and promote the recycling of organic resources.
2. The Network shall facilitate support and cooperation among members in promoting the awareness of and developing human resources for organic resource recycling.
3. The Network shall set standards for the smooth distribution of products made from recycled resources in the region and develop these standards in stages into international standards.
4. For the smooth promotion of the activities described above, the Network shall strengthen its links to and cooperation with organizations engaged in similar activities in other areas, such as Europe and the United States.

5. The Network shall conduct other activities required for the achievement of its aim.

●Article 6. Member Activities

1. Members, in carrying out activities set forth in Article 5, shall make efforts to increase members and may, if necessary, establish a regional organization of the Network following discussions among and approval from members in each country and region.
2. Members shall establish their own Web sites as early as possible and link them with other Web sites both within and outside the region to facilitate exchanges of information.
3. Members shall autonomously conduct their activities at their own discretion and cost.
4. Members shall be expelled when they have been found to have acted against the interest of the Network.
5. English shall be the common language among members.

●Article 7. Steering Committee

1. The Network shall be managed by a Steering Committee.
2. The Steering Committee shall have one Chairperson and one Vice Chairperson as directors. Directors shall be elected by the committee members and may be reelected.
3. The Steering Committee shall do following activities.
(1) Deciding ANOR's activity plan.
(2) Modification of ANOR's rules
(3) Admissions of new members.
(4) Preparing and calling General Meeting
(5) Other issues as deemed necessary.
4. The Steering Committee shall hold a meeting at least once a year and any time when a majority of the Steering Committee members require that it do so.
(1) A Steering Committee meeting shall be chaired by the Chairperson, or by the Vice Chairperson in case the former is not capable of participating.
(2) The Steering Committee shall make decisions by a majority vote of the Steering Committee members attending the meeting.

●Article 8. Steering Committee members

1. The number of the Steering Committee members shall be from five to nine.
2. The Steering Committee members shall be elected by a vote of member representatives at a General meeting.
3. The number of Steering Committee members from each country or each region shall be limited to one.
4. The Steering Committee members shall exchange opinions by e-mail to accomplish ANOR's activities and can fix ANOR's policy by e-mail if a majority of the Steering Committee members agree.
5. The term of service shall be two years, which may be updated.

●Article 9. General Meeting

1. A General Meeting shall be held once in two years, in principle.
2. A General Meeting shall be attended by members of the Network and shall be chaired by the Chairperson ,or the Vice chairperson of the Steering Committee in case the former is not capable of participating.
3. Each member shall have one vote and decisions shall be made by a majority vote of members attending the meeting.
4. A General Meeting shall decide the following issues.
(1) Election of the Steering Committee members.
(2) Other issues deemed necessary to be decided.

●Article 10. Secretariat

1. A secretariat shall be established for the administration of the Network.

2. The Secretariat shall remain with the organization to which the chairperson of the Steering Committee belongs.

●Article 11. Management Expenses

1. Expenses required for regional activities shall be born by regional members.
2. General expenses of the Network such as the administration cost of a Secretariat shall be covered voluntarily by the relevant parties.
3. Donations and subsidies to ANOR shall be accepted from third parties. In case of it's realization, further arrangements shall be added to ANOR's rules.

●Article 12. Fiscal Year

The fiscal year of the Network shall start the day on which a General Meeting is held and end one day before the day on which a next General Meeting is held.

●Article 13. Withdrawal from Membership

Members may withdraw from the Network at their discretion.

●Article 14. Others

Issues to be set forth for the administration and management of the Network other than those set forth in these rules shall be set forth by the Steering Committee.

Additional Provision

Despite provisions set forth in Article 10, the Secretariat shall remain with the Japan Organics Recycling Association (JORA) from the day of the first General Meeting of the Network to one day before the second General Meeting of the Network.

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MEMBERSHIP

Network members shall be organizations involved in policy-making, implementation, education, and promotion of organic recycling, including government agencies, institutes, academic societies, associations and other organizations located in Asia.
To join ANOR, fill out Application form attched and send it to ANOR secretariat
>>>Application [PDF 484KB]

MEMBER LIST

···as of August1, 2003···

South East Office, Resource NSW, New South Wales, Australia

Contact: Manager, Mr. Gerry Gillespie

Center for Resource and Environmental Studies, The Australian National University, Australia

Contact: Researcher, Dr. Sara Beavis

Center for Organic & Resource Enterprises (CORE), Australia

Contact: Chairman, Mr. Eric Love

Sustaniable System Program, Division of Science and Design, University of Canberra, Australia

Contact: Dr. Janis Birkeland

College of Environmental and Resource Sciences, Zhejiang University, China

Contact: Professor, Dr. Jianming Xu

Institute for Natural Resources and Environmental Management, Hong Kong Baptist University, Hong Kong

Contact: Director, Dr. Ming H Wong

Center for Research for Engineering Application in Tropical Agriculture, Bogor Agricultural University, Indonesia

Contact: Head, Dr. Kamaruddin Abdullah

Smart Research Institute (SMARTRI), Indonesia

Contact: Head of Environment Dept., Mr. Henine Nusa Prayuda

NGO Bunalinggungam Selaras, Indonesia

Contact: Head of Advisory Committee Dr. Budi Indra Setiawan

Deputy for Environmental Impact Management Institution Source, the Minstry of Environment, Republic of Indonesia

Contact: Ms Haruki Agustina

Japan Organics Recycling Association, Japan

Contact: Vice President, Dr. Mitsuo Chino

Biodegradable Plastics Society, Japan

ANOR

Contact: General Manager, Dr.Kazushi Ohshima

Environmental Science Research Forum of Meisei University Physical Science and Engineering, Japan

Contact: Assistant Professor, Mr. Shuji Yoshizawa

Korean Organic Resource Recycling Association, Korea

Contact: President, Dr. Jaechung Chung

Department of Environmental Sciences, Universiti Putra Malaysia, Malaysia

Contact: Researcher, Mr. Theng Lee Chong

Centre for Applied Science International Development, Auckland University of Technology, New Zealand

Contact: Adjunct Lecturer, Mr. Richard Tong

Bureau of Soils and Water Management, Department of Agriculture, Republic of the Philippines

Contact: Director, Rogelio N. Concepcion, Ph.D.

Environmentally Biodegradable Polymer Association of Taiwan, Chinese Taipei

Contact: Chairman, Dr. Chien Ming Huang

Environment and Development Foundation, Chinese Taipei

Contact: President, Ning Yu, Ph.D

Department of Land Development , Ministry of Agriculture and Cooperatives, Thailand

Contact: Deputy Director General, Mr. Chaiyasit Anecksamphant

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ORGANIZATION

STEERING COMMITTEE

Chair	Dr. Mitsuo Chino Japan Organics Recycling Association, Japan
Vice Chair	Dr. Jianming Xu College of Environmental and Resource Sciences, Zhejiang University, China
Member	Mr. Gerry Gillespie South East Office, Resource NSW, Australia
Member	Dr. Kamaruddin Abdullah Center for Research for Engineering Application in Tropical Agriculture, Bogor Agricultural University, Indonesia
Member	Dr. Jaechung Chung Korean Organic Resource Recycling Association, Korea

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ANOR Newsletter

ANOR Newsletter by JORA (2002.12.10) [PDF 12KB]

ANOR Newaletter by Zhejiang University (2003.3) [PDF 108KB]

ANOR Newsletter by JORA (2003.6.27) [PDF 12KB]

ANOR Newsletter by KOWREC(2003.6.30) [PDF 12KB]

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December 10, 2002

ANOR Newsletter by JORA (No.1)

1. Event

(1) JORA's interim reports on Organics Recycling

JORA, since the foundation on August 2000, has pursued "Technical survey and research for the effective use of organics" and "Drafting criteria, standards and manuals on organics recycling" under the technical committee.

On November 26 in Makuhari, Chiba City, three expert committees and four sub-committees made interim reports on their studies for "Biological waste recycling technology about composting, thermal energy, carbonization and animal feed", "Environmental measures and regulations about composting" and "Lumber resources recycling use"

It was our great honor that these interim reports have been highly evaluated by a large audience.

(2) International Symposium on Organics Recycling 2003 (ISOR2003) in Akita

Akita Prefectural University and JORA are going to organize ISOR2003 in Akita City from October 7 to 9, 2003 and details of the symposium can be found soon at the http://www.jora.jp/ISOR2003.

The Chairman of the organizing committee of the symposium is Prof. Dr. Chino, Chairperson of ANOR and it is our earnest desire to receive your papers.

2. Information sources

(1) Japan for sustainability

We have found a useful website called Japan for Sustainability which is a non-profit platform to disseminate environment information from Japan to the world in English. Please refer to http://www.japanfs.org and ask to send monthly free Mail Newsletter.

(a) This site has been established just a few months ago but covers wide range of environmental information by 10 categories like Energy, Global warming and by 6 players like Government, NGO/Citizen.

(b) Followings are the titles of Back number of free Newsletter

*Japan for Sustainability Newsletter (November, 2002)

Japan and Global Warming/Current situation and Various Initiatives in Japan's Transport Sector/" Unique NGOs in Japan" series No.1

*Japan for Sustainability Newsletter (October, 2002)

Fuel Cell Revolution Underway in Japan/Environmental Management Systems for All/" Toward Zero Emissions" series No.1

*Japan for sustainability Newsletter (September, 2002)
Introduction/ Japanese Companies' Initiatives Toward A Sustainable Economy/Contest For Green Local Governments.

(2) Other information sources

We also recommend other important website, available in English below.

*The Ministry of Agriculture, Forestry and Fisheries of Japan: http://www.maff.go.jp

*The Ministry of the environment of Japan: http://www.env.go.jp

*Japan International Cooperation Agency: http://www.jica.go.jp

*Environmental Technology Cooperation for the Developing Countries: http://www.apec-vc.or.jp

*Overseas Environmental Cooperation Center, Japan: http://www.oecc.or.jp

*Environmental Information Network for Asia and the Pacific: http://www.einap.org

*Japan External Trade Organization: http://jetro.go.jp

*Japan Bank for International Cooperation: http://jbic.go.jp

*Asian Development Bank: http://www.adb.org

*United Nations Environment Program: http://www.unep.or.jp

3. Establishment of the European Compost Network (ECN) and Collaboration with ORBIT/JORA

Prof. Dr. Werner Bidlingmaier, Chairman of Organic Recovery & Biological Treatment (ORBIT) kindly managed to stop over at JORA on November 15 on his way home from China and he explained about ECN and proposed collaboration ORBIT/JORA as follows.

(1) ECN

(a) Official foundation conference of ECN was held on October 18.

(b) ECN will act as an organ and under the umbrella of the ORBIT Association and this enables the ECN to work from the beginning with the existing resources and the legal basis of ORBIT.

(c) ORBIT tends to be rather academic and foundation members of ECN are organic waste experts, plant managers and compost and biowaste organizations representing more than 1000 professional composting/digestion plants from EU countries. It serves with "Quality Management in Biological Treatment of Waste" first of all for the need of the practical operation and decision makers.

(d) The objectives of ECN are to promote the adoption of sustainable systems for organic waste management through technological development and improvement practices.

(e) Please refer http://www.orbit-online.net/ECN

(2) Collaboration with ORBIT/JORA

(a) Exchange of scientific papers/Exchange of practical information/ Editing the waste glossary/Cooperation in publishing/Exchange of courses e. g. odor

(b) Orbit 2003 Perth:(http://www.orbit-online.net)
Session compost-organization/Help in advertisement by JORA/Young scientist award/Key note speaker

(c) Presentation Kassel project:
Presentation in March 2003 as a ORBIT Special/Invitation to JORA for a key notes speaker/Report there about the situation in Japan

4. Japan' s National Strategy of Biomass Utilization

On July 30, 2002, the Ministry of Agriculture, Forestry and Fisheries of Japan announced the basic plan on the National Strategy of Biomass Utilization compiled by the project team in the Ministry.

This plan is based on the recognition that the utilization of Biomass abundant in rural and urban areas in Japan is essential to establish sustainable society and nurture new strategic industries.

This team, in cooperation with other four Ministries concerned and getting cooperation from the special advisory group, will set up concrete measures and time table within this year.

ANOR Newsletter

A mini-digester network:

----------A strategy for manure disposal

Recently, animal husbandry in China has been developing very rapidly and contributed greatly to the improvement of life standard of Chinese people. The distribution of the farms has a distinguish tendency of intensification and centralization around large cities because of the economic concern. The concomitant production of manure once caused a great environmental issue in the corresponding areas. Presently, the disposal has to undergo a standard treatment technology such as anaerobic digestion, A/O process, to meet the rigid national standard for the discharge of the wastewater and solid wastes. However, a way of animal raising, typically pigs, which probably occurs in other developing countries, has a difficulty in waste disposal.

In many areas, the animal farms are not operated in a large scale; farms each having several ten heads of animals are quite popular, and distributed scatteredly in land with a small area. Two decades ago, manure, in this case, was used as an important nutrient resource and played a crucial role in better cropping. However, the importance of manure as a nutrient resource has declined with the reduction of fertilizer cost and the increase of labor and transport cost, and therefore, farmers are reluctant to use manure as "organic fertilizer". Furthermore, the large quantity of manure produced, due to the increase of animals in number, in a relative small area exceeds the loading capacity of the land around the farms. On the other hand, it is obvious that farmers are not able to establish a standard manure treatment plant individually because of the high cost. Of the limited technologies available for manure treatment, anaerobic digestion seems to be a proper way for manure treatment, which supplies farmers with biogas for energy and residues for nutrient purpose with low operation cost. However, the collection facility for manure is also prohibitively expensive for the farmers. Each farm can only build a digester small in scale. This small-sized anaerobic digester was widely adopted in China in 70s and proved unsuccessful in many places. The main problems it encountered were:

- relatively high cost in that time;
- poor liability in biogas production.

Now, farmers do not have an economic problem in building the small-sized digester as shown in Fig 1; but the liability of biogas production hampered yet the wide acceptance of the way of manure treatment. An aerobic digestion network, which is indicated schematically in Fig 2, is established by connecting these "mini-digesters" with biogas pipe system, and proved very successful in biogas supply. The biogas produced is "buffered" by the pipe system and thus an individual biogas consumer uses the biogas that probably comes from all the nearby "min-digester", avoiding the temporary biogas shortage. Experience shows a stable supply of biogas in four seasons. The liquid manure following digestion can be used for fertilization purpose since the most of the

carbonaceous materials have been removed. Field experiment shows that this kind of nutrient resource is better for cropping, especially for product quality.

(March, from Zhejiang University, China)

Fig 1. Mini-anaerobic digester.

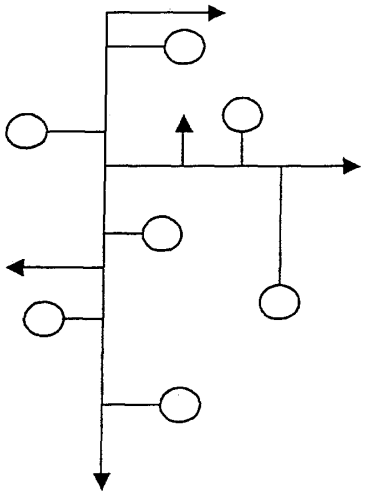


Fig 2. A mini-digester network.

: Pipe system;
: Biogas supply to farmers;
: An individual mini-digester.

ANOR Newsletter by JORA No2 (June, 2003)

1. Japan Fund for Global Environment (JFGE)

We have just started to study the possibility to get a grant from a fund called "Japan Fund for Global Environment" for ANOR activities and would like to explain this as follows.

Please refer to http://www.eic.or.jp/jfge//english/index.html and advise us of your opinion if any.

(1) Background of the Inauguration

To alleviate the global environmental crisis and to create a sustainable society, it becomes essential to collaborate internationally.

Under these circumstances, the environmental consciousness of the public has increased rapidly.

Furthermore, the roles of non-profit organizations and non-governmental organizations that act independently are attracting more international attention.

In 1992, in Japan before the Earth Summit in Rio de Janeiro, Brazil, Eminent Persons Meeting on Global Environment was held.

During these developments, the Japanese government, in addition to ODA type cooperative aid between nations, expressed policies to support environmental conservation activities of NGOs and the Japan Fund for Global Environment was established in 1993.

(2) Outline

The JFGE is supported by the government's endowment, individual donation and corporate contributions.

The investment gains (interest) and subsidies from the government are applied for the projects that support NGO activities.

(3) Grants Program

JFGE provides grants for environmental conservation activities carried out by Japanese and non Japanese NGOs (2003.4-2004.3 number of grants 218, 743million yen)

a. Environment conservation activities in developing regions by Japanese NGOs (62 projects/ 267million yen)
b. Environment conservation activities in developing regions by non-Japanese NGOs (13projects / 45 million yen)
c. Environment conservation activities in Japan by Japanese NGOs

(143projects /431 million yen)

(4) NGOs eligible for grants

Eligible organizations will be juridical persons or other organizations that are non-profit and base their activities on the public will.

This qualification includes foundations, incorporated associations, specified non-profit organizations.

Unincorporated associations are also included.

Business enterprises, local public bodies and universities are not eligible.

Because this grant program is financed with government and private contributions and the grants are awarded through an official system, it is necessary to ensure that grants are used in accordance with the stated goals and that the projects awarded grants are actually implemented.

To give this assurance, grant recipient organizations must be non-government organizations that are engaged in global environmental conservation activities.

(5) Application for JFGE grant

a. Organizations wishing to apply for the JFGE Grant must submit the "Grant Application Form" during the fixed time period for that fiscal year (beginning of January to middle of February) to the Japan Environment Corporation. (JEC)

b. JEC shall conduct a review and hearing on the contents of the grant applications. An informal decision on Grant recipient and Grant amounts will be made based on the opinion of the JFGE Management Council. The selected organizations will be sent a notification of informal approval for JFGE Grant. (End of May)

c. If the selected organization decides to accept the contents of the informal approval, the organization must prepare the Letter of Consent for JFGE Grant based on the informally approved amount and send it to JEC within a month.

d. JEC, upon receipt of the Letter, will examine the contents of the Letter and then send a Notification of JFGE Grant Approval to the approved organization. (End of June)

(6) Others

a. In case of foreign organizations, they' ll have to apply to JEC through Japanese representatives.

b. One organization can do one application in a year.

c. Average grant amount will be set at 4million yen for projects in Japan and 6million yen for projects in developing regions.

2. Environment Information

As we informed you by our ANOR Newsletter No1 dated 10/Decemer, 2002, we have found a useful website called "Japan for Sustainability (JFS)" which is a non-profit platform to disseminate environment information from Japan to the world in English. (http://www.japanfs.org)

Please refer attached articles from JFS.

(1) Environmental ODA down to 222.2billion yen-FY 2002 ODA White Paper.

(2) Japan' s Sustainable Society in the Edo period1. (1603-1867)

(3) Japan' s Sustainable Society in the Edo period2.

1st Newsletter by KOWREC (6/30/2003)

◎ Recent Movements of KOWREC

1. 2003 General Meeting of KOWREC

2003 General Meeting of KOWREC was held on 18th. of April at Korea Environmental Institute in Seoul. Dr. Jae-Chun, Jung was elected as the new president of 2003 KORWEC. He is one of the foundation members of KORWEC and this election is his second one since 1997-1998. In his inauguration speech, Dr. Jung promised to do his best for the second jumping and further development of KOWREC during his one-year term. 2003 spring conference of KOWREC was also held on the same day at the same place with the title of "Seminar on the current techniques of sludge disposal, and each local autonomous entity's counterplot to the prohibition policy of direct sludge landfill"

2. Changing KOWREC to KORRA

KOWREC has positively been considering for the change of the title from KOWREC to KORRA (Korean Organic Resource Recycling Association). This idea is emerged from a point of view that organic wastes are no more waste products, it should rather be considered as recycling resources. By changing the title, KOWREC wants to reap further by recruiting new members and broadening the scope of the research area.

3. Publishing a book entitled "Food Waste Management and Recycling"

KOWREC recently published a book entitled "Food Waste Management and Recycling" through the sponsorship of United States Grains Council (USGC). This book, written in Korean, covers broad techniques, policies, and resource plans of food wastes discussed so far in and out of the nation. KOWREC hopes that this book contribute to the sound management and efficient recycling policy of organic waste materials such as food wastes. USGC has been supporting the activities of diverse environmental researches and environment-related groups since 1995 in Korea. The main supporting area of USGC has been focused on the development of biodegradable plastics.

◎ Recent News and Issues on Organic Wastes Recycling in Korea

1. The present situation of the recycling food wastes

At present, food waste products are generated more than eleven thousand tons per day in Korea. 6,400 tons of these waste products, corresponding to 57% of the total amount, are now recycled in a day. The recycling rate of food wastes has been increased up to more than 5 times since last five years (21.7% in 1997, 45.1% in 2000, and 56.8% in 2001). Among food wastes recycled, about 53.3% (3,399 tons/day) goes to the feeding, 41.9% (2,572 tons/day) to the composting, and 4.8% to other areas, showing that the feeding records the highest rate of the recycling of food wastes. 63% of plants (corresponding to 4,308 tons per day) are run by private entities, whereas 37% of those are run by the public institutions, indicating that the private facilities are dominated over the public ones in compost recycling industry in Korea.

2. Worrying about the treatment of sewage sludge

Recently, great concern about how to dispose the sewage sludge is seriously arising in Korea, due to the enforcement of the banning of landfill, which will be enforced on July this year, and the anxiety about the strict regulation of ocean dumping in the near future. To make it worse, annual increase of the sludge generated exceeds much beyond the capacity of the treatment, though quite a lot of wastewater treatment plants are constructed every year, So we are now faced up with a situation where a mid- and long-term policy should be re-established for a new sludge treatment system which can be managed in a more efficient and cost effective way.

3. Governmental policy for the active utilization of the recycling products

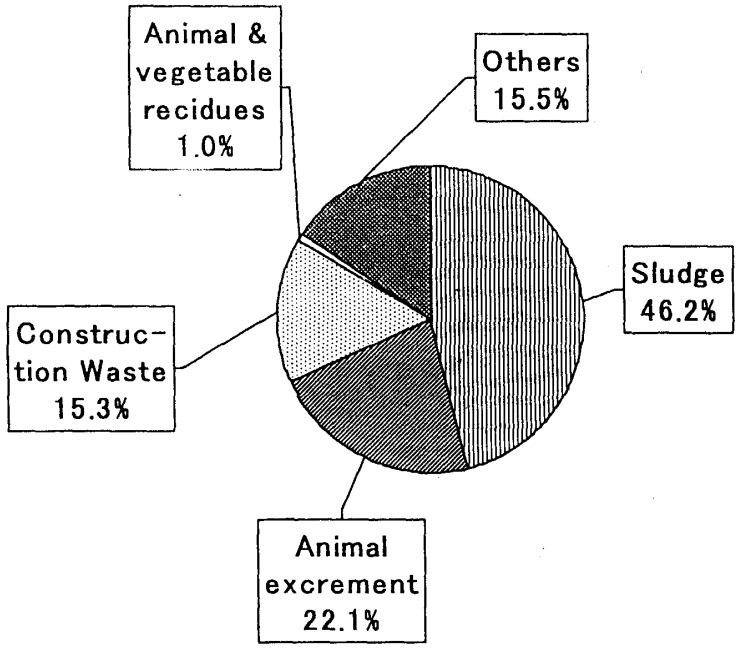
Good Recycling (GR) system is newly introduced into the recycling composts, in addition to some recycling products approved already as GR. By a law for the promotion of recycling products and the economical use of resources (an article 39 enacted in 2002),

Ministry of Environment enforced the public institutions to purchase and distribute to the farmers the good-quality organic recycling products such as GR marked composts, if needed. This enforcement will preferentially be applied to the farmers who live in the water protection areas near four korean primary rivers (Han rivers, Nakdong rivers, Youngsan rivers, and Kum rivers), where any polluting behaviors are strictly prohibited. A fund for this operation is already prepared and waits for its use this year. Ministry of Commerce, Industry and Energy also revised and notified an ordinance for the qualified recycling products in which how to recognize the recycling compost as GR product is described.

Promoting the Creation of Recycling-oriented Society

Professor, Dr. Akikuni Ushikubo
Faculty of International Agriculture and Food Studies
Tokyo University of Agriculture

Present Situation of Waste generation
[Industrial Wastes (**20items**)]

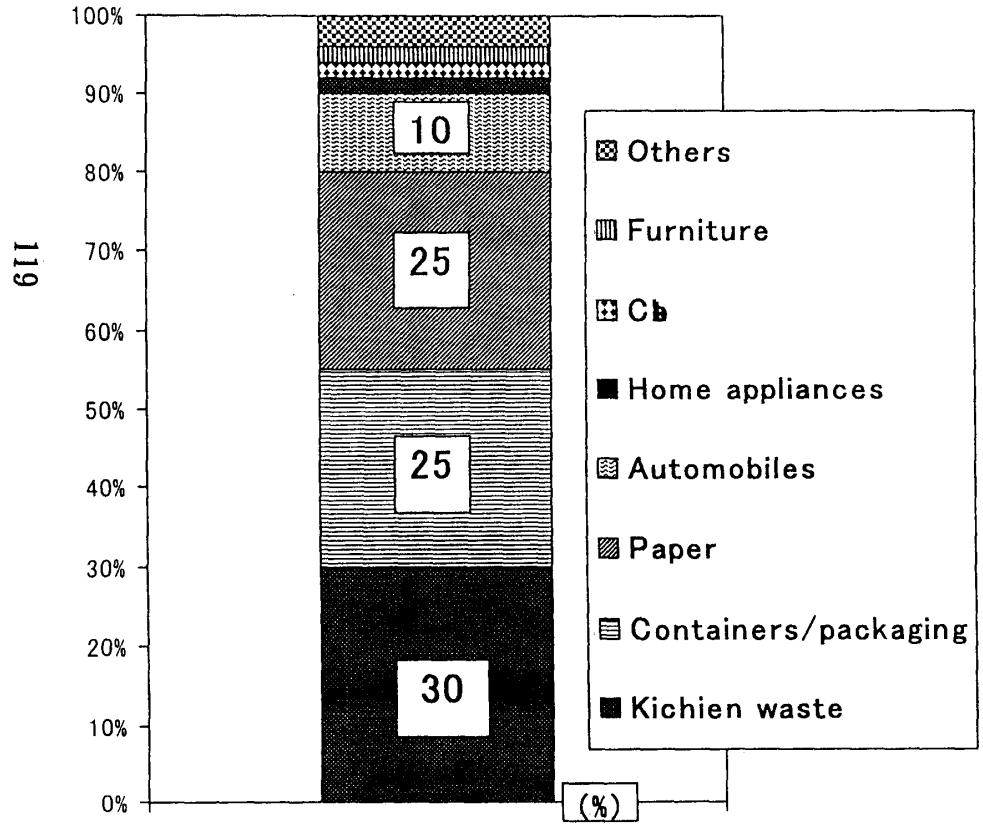


Generation amount of Industrial Wastes in 2000

406 Million **tons/year**

Recycling Rate = 41%

Present Situation of Waste generation
[Municipal waste]



119

Generation amount
of Municipal Wastes
in 2000

50 Million **tons/year**
(1,132 g / person / day)

Establishment of the New Recycling Low

Constraints on environment and resources are the biggest problem facing the sustainable development of Japan in the 21st century.

The most pressing issue is to withdraw from a mass Production, mass consumption, mass waste economic System. ⇒ Urgent task to create a recycling system

(1) Constraints on final disposal site
Remaining life of landfill site Municipal waste 8.5 years,
Industrial waste 3.1 years
(2) Problems of Dioxins from incineration
(3) Constraints on natural resources

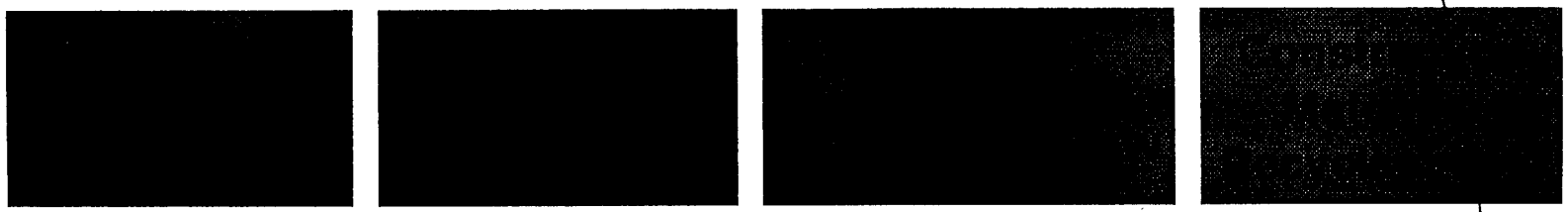
The Legislative System and Targets for Waste Reduction and Recycle

Basic Low on the Environment (Enforcement: August,1988)

Basic Low for Promoting the Creation of a Recycling-Oriented Society (Enforcement: January,2001)

Waste Management Low
(Enforcement: April, 2001)

Low for Promotion Effective Utilization of Resources
(Enforcement: April, 2001)



Outline of the Basic Low for Promoting the Creation of a Recycling-Oriented Society

1. The recycling-oriented society to established
   a) Waste reduction, b) Promotion of use of recycled
   c) Appropriate disposal
2. Definition of useful legally targeted waste as "Recyclable resources"
3. First legislation on "disposal priority"
   Prioritized in relation to the following;
   1. Waste reduction 2. Re-use 3. Recycling
   4. Energy recovery 5. Safe disposal

The Law for Promotion of Utilization of Recycling Recyclable Food Resources

(Common name: The Food Recycling Low)

Food Recycling Law was enforced in May, 2001.

Food waste is generated during the production, cooking, distribution and consumption stages.

This Low enacted to reduce the final amount of waste by reducing the generation of food waste and recycling it as feed, fertilizers and methane gas etc..

Present Situation of Food waste generation and Recycling

	Generation (X10^{4}t/y)	Treatment Methods (X10^{4}t/y)				
		Landfill and /or Incinerate	Recycle			
			Fertilizer	Animal Feed	Others	Total
Municipal Waste Food Related Business(A) Household	1,600 600 1,000	1,595 (99.7%)	5 (0.3%)	-	-	5 (0.3%)
Animal & Vegetable Residues (Industrial waste) (B)	340	177 (52%)	47 (14%)	104 (31%)	12 (3%)	163 (48%)
Total Generations of Food Related Business Wastes (A+B)	940	775 (83%)	49 (49%)	104 (31%)	12 (3%)	165 (17%)
Total Generation of Food Wastes	1,940	1,772 (91%)	52 (3%)	104 (31%)	12 (3%)	168 (9%)

Framework of the Food Recycling Low

Definition of Food waste;

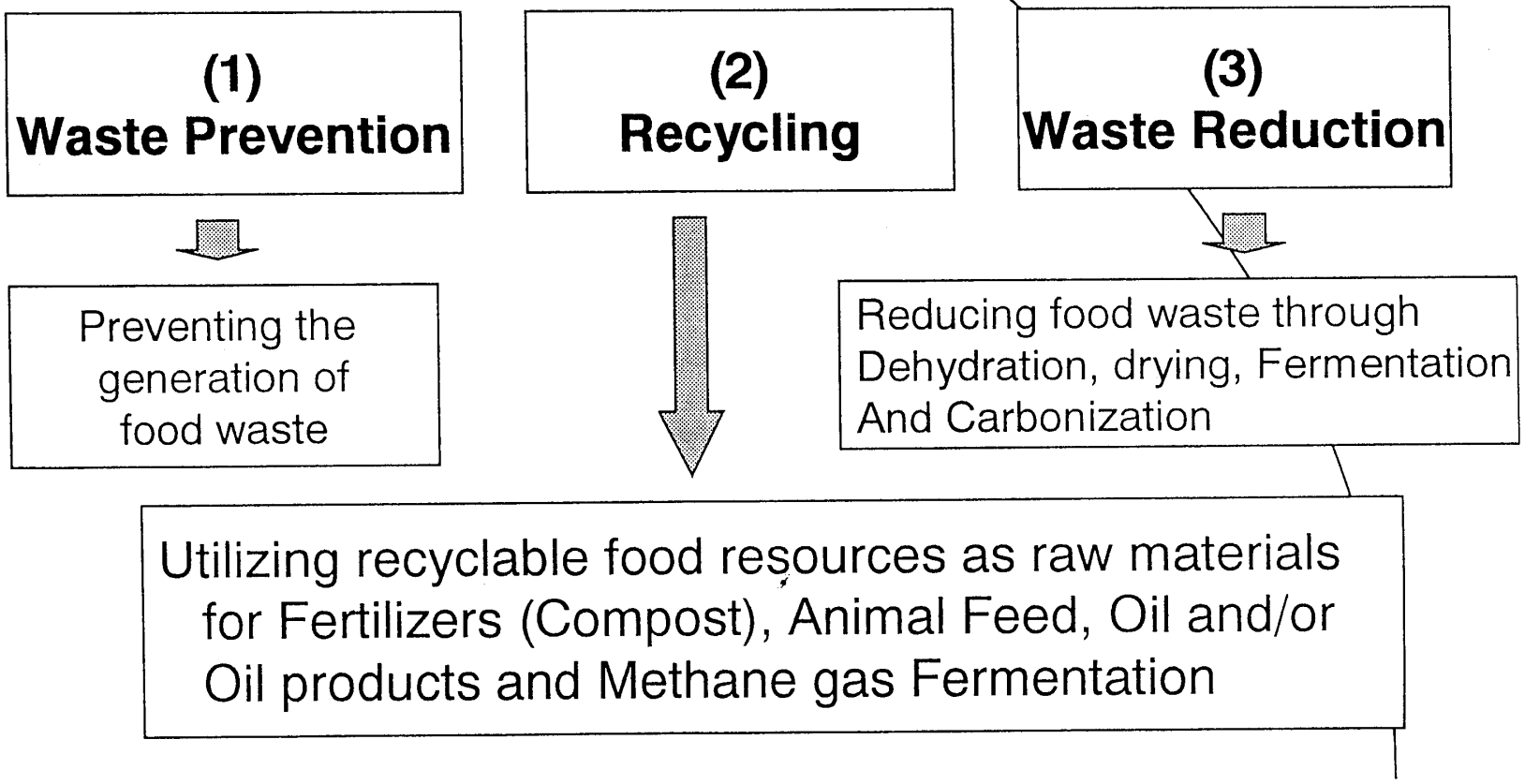
1) Food that is unsold and uneaten
2) Waste generated in the manufacturing, processing and cooking stages

Related Companies to this Low;

1) Food manufacturers, processors, wholesalers and retailers (e.g. Food manufacturers, Department stores and Super-markets etc.)
2) Restaurants and other businesses who provide food (e.g. Restaurants, hotels and inn etc.)

Framework of the Food Recycling Low

Disposal Priority;



Problems of Food Waste as Raw materials for making compost

1. **Quantity and Quality of Food wastes are inconstant.**
2. **High Moisture content**
3. **High Concentration of Salt**
4. **High Concentration of Oil**

[Key Points of as Raw Materials]

a) Separation of Food Waste by type

b) Keeping for Freshness condition

附　錄　六

德國 DIN CERTO,美國 BPI 及日本 BPS

之合作協議書

AGREEMENT

on co-operation

between **DIN CERTCO Gesellschaft für Konformitätsbewertung mbH**
Burggrafenstraße 6, 10787 Berlin, Germany

- referred to below as DIN CERTCO -

and **Biodegradable Products Institute**
331 West 57th St, Suite 415, New York, NY 10019, USA

- referred below as BPI -

and **Biodegradable Plastics Society,**
26-9 Hatchobori 2-Chome, Chuo-Ku, Tokyo 104-0032, Japan

- referred below as BPS -

§ 1 General

(1) DIN CERTCO, BPI and BPS have developed certification and identification programs to distinguish biodegradable and compostable materials and products that meet scientifically based specifications.

(2) DIN CERTCO, BPI and BPS are committed to developing certification systems which rely on similar measurements of inherent biodegradability, disintegration and ecotoxicity. DIN CERTCO's standard for testing and certification is DIN V 54900-1 to –3, DIN EN 13432, and ASTM D 6400-99. BPI's standard for testing and certification is ASTM D 6400-99. BPS's standard for testing and certification is JIS K 6950, JIS K 6951, JIS K 6953 and the GreenPla Identification and Labelling System (First Edition April 1st 2000) for measuring biodegradability. Also, the BPS is currently developing tests and specifications for assessing disintegration.

(3) With this agreement DIN CERTCO, BPI, and BPS harmonise the recognition of testing laboratories, and the acceptance of test reports in order to expand the use of biodegradable / compostable materials and products as rapidly as possible.

(4) This agreement recognises that plastic products wishing to be certified by each organisation must also comply with national and local regulations, especially in the areas of heavy metal limits and eco- and phytoxicity standards.

§ 2 Subject matter of contract

DIN CERTCO, BPI , and BPS will develop and maintain a harmonised system for the recognition of test reports and testing laboratories for biodegradable / compostable materials and products.

§ 3 Recognition of testing laboratories

(1) Testing laboratories may only be recognised by a party to this contract if they meet the criteria for testing laboratories that are outlined in paragraph 4.

(2) Testing laboratories need only be recognised by one of the parties to this contract.

(3) Testing laboratories shall only be recognised if they have proven that they possesses the necessary competence for testing and fulfil the requirements of paragraph 4. This proof may be provided with an appropriate accreditation. Otherwise the party to this contract where the testing laboratory has applied for recognition has to audit the testing laboratories.

(4) Testing laboratories that cannot prove that they possesses the necessary competence for testing according to paragraph 4 by an accreditation are to be audited at least every three years. Audit reports shall be send to each party to this contract in due time after every audit. Audits should be conducted following similar procedures as for an accreditation. The following aspects should be evaluated and approved:

- Independence and objectiveness of laboratory
- Organization and personnel: Organization chart, qualification, experience, independence, clear definition of respective responsibilities, availability of sufficient personnel, system of replacement, in-service training
- Quality assurance program: Availability, review and control of measurements, data, calculations and reporting by quality control manager not directly involved in test him/herself.
- Facilities: Sufficient size, accessibility, floor plans, archive room, proper waste disposal,
- Apparatus, materials, reagents and specimen: Maintenance, calibration, validation, capacity, labeling
- Test systems: Checking of integrity, contamination, participation in round-robin tests
- Test and reference substances: Receipt, storage, identification, stability and retention.
- Standard operating procedures for all activities in a testing laboratory including revisions and deviations.
- Studies: Presence of study plans, complete reports, traceability of results, calculations and raw data.
- Storage and retention of records and materials.

(5) The party to this contract that has recognised a testing laboratory remains liable for an ongoing surveillance of the recognised testing laboratory in order to make sure that the testing laboratory still meets the requirements of paragraph 4.

(6) The recognition of a testing laboratory has to terminate if nonconformities to the requirements of paragraph 4 are repeatedly detected in the course of surveillance of the testing laboratory that are not eliminated despite the laboratory's being called upon by a party to this contract to do so.

§ 4 Requirements for testing laboratories

(1) Testing laboratories shall execute their tests in accordance with the specifications of the standards ISO/IEC 17025 " General requirements for the competence of testing and calibration laboratories", JIS Q 17025 "General requirements for the competence of testing and calibration laboratories", EN 45001 "General criteria for the operation of testing laboratories", ASTM E 548-94e1 "Standard Guide for General Criteria used for the Evaluation of Laboratory Competence", the OECD-fundamentals of good laboratory practice (GLP) or equivalent specifications established by provincial, prefecture, state or local governments, respectively.

(2) If equivalent specifications established by provincial, prefecture, state or local governments are used as a basis of operation by a testing laboratory that has been recognised by a party to this contract, all parties to this contract shall be informed of these specifications in order to check whether they are comparable with ISO/IEC 17025 " General requirements for the competence of testing and calibration laboratories", JIS Q 17025 "General requirements for the competence of testing and calibration laboratories", EN 45001 "General criteria for the operation of testing laboratories", ASTM E 548-94e1 "Standard Guide for General Criteria used for the Evaluation of Laboratory Competence" or the OECD-fundamentals of good laboratory practice (GLP).

(3) Testing laboratories shall operate independently, maintaining their neutrality irrespective of any and every economic dependence deriving from possible ownership structures or contractual relationships.

(4) The testing laboratory is encouraged to exchange their experiences with other recognised testing laboratories in order to improve the effectiveness and accuracy of the test methods.

(5) Changes that concern the conditions on which recognition is granted shall be communicated to the party to this contract that recognised the testing laboratory without delay.

(6) The testing laboratory undertakes to treat as confidential all matters and technical details that become known to it in connection with its testing activities and in no circumstances to pass on such information to outside parties.

§ 5 Register of recognised testing laboratories

Testing laboratories that have been recognised shall be entered in a register of recognised testing laboratories.

§ 6 Acceptance of test reports

Test reports from recognised testing laboratories by a party to this contract shall be accepted by all parties to this contract.

§ 7 Certification

(1) Each party to this contract will certify materials and products based on test reports of recognised testing laboratories independently.

(2) Each party to this contract will certify materials and products according to their regulations and will collect revenues for the certification or the display of their respective logo as per the fee structure established by their own organisation.

§ 8 Duty to co-operate and inform

DIN CERTCO, BPI, and BPS will inform each other on their policies to recognise testing laboratories, and on changes in their register of recognised testing laboratories.

§ 9 Accreditation and Peer Review

(1) To help improve the credibility of the certification programs, all parties to this contract agree to assess their ability to provide an accreditation for the certification of compostable materials and products according to EN 45011 "General requirements for bodies operating product certification system" or ISO/IEC Guide 65 "General requirements for bodies operating product certification systems" or JIS Q 0065 "General requirements for bodies operating product certification systems" two years after signing this contract.

(2) Should two parties to this contract have serious doubts on the correct fulfilment of this agreement by a party to this contract, a peer review shall be conducted. The peer review shall be conducted by one auditor from each of the two parties that raised the complaint or the objection. In the event that the objection brought forward was justified, the costs of the audit are to be reimbursed by the party that has been audited. In the event that the objection brought forward was not justified, the costs of the audit are to be reimbursed by the party that raised the objection.

(3) In the event that a party to this contract did not fulfil this agreement and a objection was verified during a peer review, appropriate measures have to be taken to guarantee the continued fulfilment of this contract again. These appropriate measures shall be proposed by the party to this contract that did not fulfil this agreement, and shall be accepted by the parties to this contract that raised the objection.

§ 10 Confidentiality

(1) The employees of DIN CERTCO, BPI, and BPS and the assessors they appoint undertake to treat as confidential any information they may obtain in connection with the recognition and surveillance of the testing laboratory.

(2) No information may be given to outside parties with respect to activities connected with the recognition and surveillance of the testing laboratory except with the express permission of those involved.

§ 11 Liability

The parties to this contract are liable for the performance of their contractual obligations.

§ 12 Other interested Parties

To encourage comparable tests and specifications globally, DIN CERTCO, BPI and BPS will strive to establish relationships with other interested organisations and parties. However, it is

agreed that other interested parties may enter into this or a similar agreement with one of the parties to this contract only with the written permission of DIN CERTCO, BPI and BPS.

§ 13 Contractual period

This agreement is concluded for 5 years and may be renewed for a second 5-year period or may be terminated by any party by giving six months notice to the end prior to withdrawing.

Berlin, New York, Tokyo, December 10th, 2001

Dr. Ohshima, Kazushi
General Manager of the BPS

Ryouji Ishioka
BPS Certification System Committee Chairman

Tony Kingsbury
President of the BPI

Ramani Narayan, Ph.D.
BPI Scientific Committee Chairman

Jürgen Neun
Managing Director of DIN CERTCO

Jörn Reske
DIN CERTCO Certification Committee Chairman

Format B

Date*

To: Chairperson of Identification and Labeling Committee
Biodegradable Plastics Society

☐Area Code & Address
☐Company Name (Stamp)
☐Name of Person Representing Company
☐Name and Title of Window Person
☐Telephone No.

Request to Add A Substance to Positive List Version 1 (original)

As captioned, I would like to request to add a new substance to Positive List, attaching the required material.

1.Substance Name	(Officia gazette reference number of Chemical Substances Control Law)		
2.Chem Structure (Formula)			
3.PL Name & Class	(PL Name)	(PL Class)	
Note: Fill a PL name for amendment or a name (substance name or abbreviation) to PL for addition.			
4. Other criteria for certification		Date	
Name of Certification		Valid until	
Organization		Applicant	
Certified Product		Scope	

Description of outline of certification conditions (criteria):
(If available, material for description may be attached as Annex 4.)

If criteria are consistent with any of test methods of biodegradability, check it with a circle (○) and fill its max. rate of degradability .	Max. Rate of Degradabili	Test Method of Biodegradability	Check with ○	Information on substance tested (like shape, etc)
	%	OECD301C		
		ISO14851		
		ISO14852		
		ISO14855		

Item for assessment of environmental safety	Method of Assessment	Information on substance tested	Information on Safety (LD_{50}, etc.)

Note: (a) Fill clearly all information on safety tests.

(b) When the appointed space is not enough for filling, use a separate A4 paper as attachment ( ).

Format X

Date:

To: Chairperson of Identification and Labeling Committee
Biodegradable Plastics Society

☐Area Code & Address
☐Company Name
☐Name of Person Representing Company (Stamp)
☐Name and Title of Window Person
☐Telephone No.

Request to Approve (New/Modified) Use of Symbol Mark (original - copy)

As captioned, I would like to request to issue an approval of use, attaching the required material.

1.GreenPla® Name	(Approval reference number)			
2. Raw Materials composing Product All raw materials names (substance names) are to be mentioned	Name of Raw Material	Content (wt%)	PL No.	Remarks

Attention: A raw material name is mentioned by chemical structure (formula) or chemical formula in principle. A general name in common use is allowed but a specific name like trade name is to be avoided. An approval reference number may be referred to the Positive List. All substance components are to be listed on the Positive List.

3.Contents of Specified Elements A measured value by an analytical method of with effective accuracy or a reasonable estimated value is to be mentioned. For the measured value, an analytical report, and, for the estimated value, material showing reasonable grounds are to be attached.	Element Name	Content (ppm)	Element Name	Content (ppm)	Element Name	Content (ppm)
	Cd		Hg		Zn	
	Pb		Cu		Mo	
	Cr		Se		F	
	As		Ni			

4.Molding(Fabrication) Conditions, etc. Special mention on methods of molding (fabrication) of a product is to be filled, if any.	
5.Use Contents of Symbol Mark (Use Range)	

Note: (a) Prepare an original and a copy.
(b) As to a copy, do not fill the information on the applicant at ☐☐☐☐&☐.
(c) (N 1) in the left column is a number for attached material.

附　錄　七

日本生物可分解塑膠協會之 Green Pla

標章驗證方式

GreenPla®® Identification and Labeling System

April 2000
The First Edition

Biodegradable Plastics Society

Introduction

GreenPla® Identification and Labeling System is a system to approve the use of GreenPla® symbol mark provided by our society to GreenPla® (product)、which complies with the criteria for identification and labeling separately laid down by our society, with the intention of the consuming public to easily identify GreenPla®. GreenPla® here described means a substance or a product including biodegradable organic substance as a component that may be degraded by microorganisms in natural environment and that may finally become carbon dioxide and water. The identification and labeling system of our society is to aim at spreading the consuming public's understanding of GreenPla®, having its right method for use infiltrated and promoting diffusion of GreenPla® (product).

[Definition]

- GreenPla®: A general term of GreenPla® raw materials of such GreenPla® products as films and press sheets including 50.0 weight per cent or more, or 50.0 volume per cent or more in a product of total amounts of biodegradable plastics (Resin: PL class A) and natural organic substance such as cellulose and conforming to the criteria for identification and labeling laid down by our society, and of pellets being composed of biodegradable plastics as a main component.
- Product: What is generally recognized as plastics, commercially transacted, used and totally uniform.
- Substance: What is used to make a product and exists in the product. However, in case of a product that is made by a manufacturing method utilizing chemical reaction, its reaction product comes under a substance as well.
- Component: A single material among substances.
- Inorganic substance (component): What is only composed of inorganic ones among substances and components.
- Organic substance (component): Substances and components excluding inorganic ones.
- Natural organic substance (component): Naturally existing substances and components among organic substances.
- PL (Positive List): A list mentioning substances and components that were judged to be suited to make products conforming to GreenPla®.
- Symbol mark: A mark for identification and labeling that may be given to GreenPla® approved by our society.

1. Criteria for Identification and Labeling

(1) All constituent substances (components) of GreenPla® are to be listed on the PL (Positive List) prepared by our society.

(2) GreenPla® is to comply with the Rules for Positive List.

(3) All constituent substances (components) of GreenPla® are to be disclosed to the Identification and Labeling Committee (the Committee) of our society.

(4) GreenPla® is to include 50.0 weight per cent or more, or 50.0 volume per cent or more of organic substances (total amounts of resins: PL class A and natural organic substances: PL class B-8) in a product.

(5) Amounts of specified elements included in GreenPla® are not to exceed the upper limits of the Annex 1.

References

- CEN/TC261/SC4/WG2 N4; Requirements for packaging recoverable through composting and biodegradation - Test scheme and evaluation criteria for the final acceptance of packaging
- MAFF (Ministry of Agriculture, Forestry and Fisheries) Notification #117 (1950); Specific Fertilizers, etc. based on Fertilizer Control Law
- EA (Environmental Agency) Notification #46 (1991); [Environmental Standards relating to Soil Contamination](Soils in agricultural and farming lands)
- PMO (Prime Minister's Office) (1973) Ministerial Ordinance; [PMO Ministerial Ordinance prescribing the Judgement Criteria relating to Industrial Wastes including Metals, etc.](Annex 1)

Annex 1 Upper Limit of Contents of Specified Elements in a Product

Name of Element	Upper Limit, ppm	Name of Element	Upper Limit, ppm
Cadmium (Cd)	0.5	Selenium (Se)	0.75
Lead (Pb)	50.0	Nickel (Ni)	25.0
Chromium (Cr)	50.0	Zinc (Zn)	150.0
Arsenic (As)	3.5	Molybdenum (Mo)	1.0
Mercury (Hg)	0.5	Fluorine (F)	100.0
Copper (Cu)	37.5		

Note: Values by chemical analyses of specified elements in GreenPla® are to be measured values by the analytical methods with effective accuracy or to be estimated

values obtained on a basis of reasonable grounds. As a method of chemical analysis, atomic absorption spectrophotometry, fluorescent X-ray spectroscopy or absorptiometry is general, but, in case of other methods, the material briefly describing their operating methods is to be attached to the application.

2. Standards for Use of Symbol Mark

(1) The Committee will judge anything on the identification and labeling of GreenPla®. Those who would like to use a symbol mark are to follow the Committee's instruction regarding the identification and labeling of GreenPla® concerned.

(2) Those who would like to use a symbol mark are to give notice to the Committee of their use contents in a written application and to receive its approval of use.

(3) Those who have received the approval of use of a symbol mark are to deposit GreenPla® branded by the symbol mark to the Committee.

(4) The term of validity for use of a symbol mark is 3 years from the date of approval for use. However, it is not a case when it is applied for renewal within a period of time.

(5) Those who would like to change their use contents of symbol mark are to submit the changed contents to the Committee in advance.

(6) Those who have changed their constituent (component, form) contents, when the contents are remarkably different from the product ones approved of use by the Committee, are to immediately discontinue their use of symbol mark for the product concerned. However, it is not a case when they have newly applied in advance for approval for use of symbol mark regarding their changed contents or have received the Committee's guidance to their reports to the Committee.

(7) When they have doubts about the use of symbol mark, they are to consult with the Committee and to receive its guidance.

(8) Regarding the use of symbol mark, those who received its approval for use are responsible for anything.

(9) When they discontinue the manufacture of GreenPla® approved of use of symbol mark or discontinue the use of symbol mark to the GreenPla® concerned, they have to report it to the Committee on the date of discontinuation of manufacture or within one month of the date of discontinuation.

(10) When the applicant leaves our society, our approval for use of symbol mark becomes invalid as of the date of leave.

3. Application for Use of Symbol Mark

(1) Those who would like to receive a new approval for use of symbol mark or to change the applied contents of use of symbol mark already approved have to submit an application to the Committee following the Committee's criteria for identification and labeling and its standards for use.

(2) Regular, supporting and mark members of the Biodegradable Plastics Society may apply for use of symbol mark following below.

① They are to mention all substances (components) composing GreenPla® intended for application and their amounts of use in a written application (Format X).

② They are to mention measured values or reasonably estimated ones of the specified elements (Annex1) included in GreenPla® intended for application in a written application (Format X). As for the measured values, an analysis report relating to a method of analysis, etc. is to be attached to, or as for the estimated values, their reasonable grounds are to be mentioned clearly.

③ They are to mention special features regarding the methods of molding (fabrication) of GreenPla® intended for application in a written application (Format X), if any.

④ They are to mention the contents and ranges of use of symbol mark in a written form (Format X).

⑤ An applicant is to submit a written application (Format X) with attached material requested in ② and together with GreenPla® to be applied to the Committee.

⑥ A judged result is to be notified to an applicant by a permit of use of symbol mark issued by the Committee (its reasons, if unapproved).

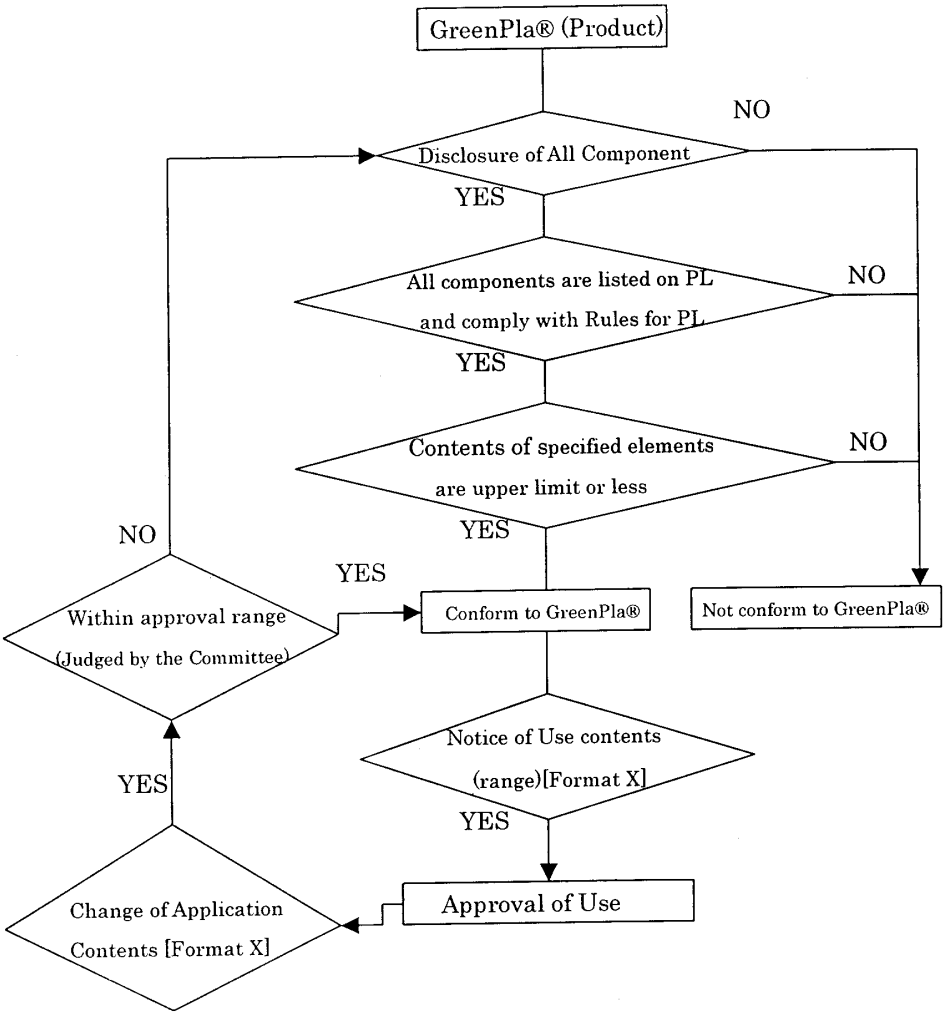
(3) A written application, its attached material and its deposited GreenPla® are to be strictly had in the Committee's custody, and the confidentiality of applied contents is to be strictly kept. However, GreenPla® (product name) using symbol mark may be introduced on our web site, etc.

Reference

Annexed material: Format X

4. GreenPla® Conforming to Identification and Labeling

It is to be confirmed by the following flow chart if a GreenPla® may comply with the Committee's criteria for identification and labeling or not.



GreenPla ® Identification and Labeling System
Practice Agreement

April 2000

Biodegradable Plastics Society

This agreement puts our practice rules in order relating to the following system and rules:

- GreenPla Identification and Labeling System
  - Annexed Material Format X

- Rules for Positive List
  - Annexed Material Formats A, B & C
  - Attached Material About Test Methods Necessary for PL Listing
  - Other Material MITI Consigned Study Report:
    A Study on Measures for Improvement of Safety in Bioindustry
    - A Study on Safety, etc. of Biodegradable Plastics -
    (Foundation: Japan Bioindustry Association(JBA))

1. Organization

(1) The GreenPla Identification and Labeling System (the System) is put in practice by the Identification and Labeling Committee (the Committee) which is established in the Biodegradable Plastics Society (BPS).

(2) The Committee is made up of a Chairperson, the Examination Division with 5 persons or more, the Mark Control Division with 3 persons or more and the Rules Review Division with 5 persons or more. The Committee and each Division meetings come into effect by more than the two third persons present of its constituent members.

(3) The BPS Vice President becomes the Chairperson of the Committee.

(4) Members of the Examination Division, members of the Mark Control Division and members of the Rules Review Division are appointed by the Chairperson of the Committee from BPS members.

(5) Each Division member's term of service is one year, in principle, and his continued term of service is limited to one more year.

(6) As a rule, half of each Division members are replaced per each term of service.

(7) The expenses for activities of the Committee are allotted mainly from entrance fees/annual membership fees of mark members and examination fees.

(8) The BPS Secretariat does office work.

2. Mark Members

(1) In addition to a regular membership and a supporting membership, a mark membership is introduced to the BPS. The rights and duties of mark members are limited to matters related to practices of GreenPla Identification and Labeling System.

(2) The entrance fee and annual membership fee of a mark member is separately prescribed in the BPS Agreement.

3. Application

(1) Applications (application for positive list, application for approval of GreenPla product and application for use of mark) are made only by BPS members (regular members, supporting members and mark members)

(2) Application material for positive list is as follows:

- For application for addition and amendment of the PL first version: Format A
- For application for addition and amendment to the PL first version: Format B
- For application for addition and amendment of other substance to the PL first version: Format C

(3) Application material for approval of GreenPla is Format X and Product samples which clearly mention main intended uses.

(4) An applicant submits a written application following the GreenPla Identification and Labeling System Agreement.

(5) The BPS secretariat confirms formally if necessary material is prepared and then is up for consideration at the Examination Division.

(6) Application material and product samples are used only for consideration at the Committee but not for other objects. They are strictly controlled but not disclosed to the outside.

4. Examination

(1) The Examination Division examines an applicant's material on a basis of the Identification and Labeling System Agreement.

(2) The Examination Division may ask an applicant to submit additional or supplementary material, when there are questionable/obscure points.

(3) The judgement at the Examination Division accepts a majority decision of the 2/3 of the members of the Examination Division.

(4) The judged result at the Examination Division is reported to the Committee and confirmed by the Chairperson of the Committee.

5. Record

(1) A substance, which has received an approval of Positive List, is listed on Positive List, and it is notified to an applicant.

(2) A product, which has received an approval of GreenPla, is listed on the list of approved products, and it is notified to an applicant.

(3) A product, which has received an approval of use of mark, is given an approval number, and it is notified to an applicant.

(4) About a product, which has been not approved, it is notified to an applicant together with its reasons for no approval.

(5) The positive list of substances and list of approved products are distributed to BPS

members regularly or every time of addition/amendment, and simultaneously opened to the public on BPS web site.

6. Mark Control

(1) The Mark Control Division investigates regularly if the GreenPla Identification and Labeling Agreement is properly implemented in the market or not.
(2) The results of investigation are reported to the Committee and confirmed by its Chairperson.
(3) About a product, which violates the use conditions of mark, its use of mark is discontinued, and simultaneously it is to appear on BPS web site.

7. Amendment of Criteria

(1) The Rules Review Division is responsible for the amendment of criteria. However, the Rules Review Division may ask their review to the BPS Technical Committee or other committees. Otherwise, it may organize a special committee for their review.
(2) The results of review for amendment are reported to the Committee and confirmed by its Chairperson.
(3) The Examination Division, when it has recognized the necessity for amendment of criteria, reports its opinions to the Rules Review Committee.
(4) The results of amendment of criteria are immediately disclosed to BPS members, and simultaneously opened to the public on BPS web site.

Incidental Agreement

1. Fee for Application for Mark Use: From the 2nd application, JPY1,000 per application is to be paid.

The agreement was made out on April 1, 2000.

RULES FOR POSITIVE LIST

The First Edition

Effective: April 2000

BPS

Biodegradable Plastics Society

1. Policy For Positive List

(1) A positive list (PL) is to be compiled respectively by application of substance.

(2) Substances, which may be listed on the positive list, are limited to those being currently used or those positively planned to use, and permitted to be used for "GreenPla®".

(3) Positive lists are classified as follows:

A. Resins [trade name, substance name and chemical structure are to be shown. Copolymer and block-copolymer are to be included]

B. Additives which may be used [They are to be identified by substance names. Quality, usage and/or application are to be shown if necessary.]

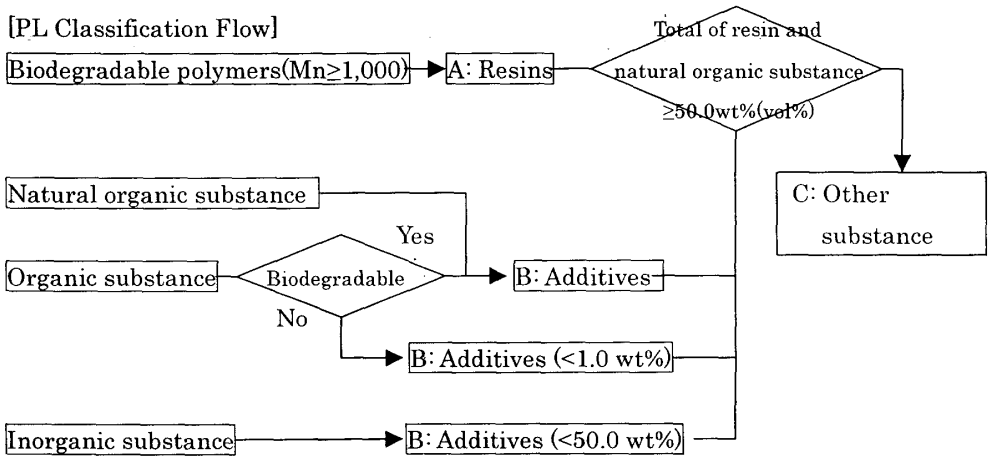
C. Other substances [They are raw materials which are resins mixed with additives. Names (product names, etc) and all components are to be shown.]

(4) Additives, which may be used, are to be so listed as categorized by applications as given in the table below. If there are two or more applications for a certain substance, such substance is listed only in its main application. In principle, it is not listed two or more lists in duplication.

[Table of PL Classification]

Class		PL Category	Remarks
A		Resins	Biodegradable polymeric substances with mol.wt. of Mn1,000 or more, including starch and polyamino acid.
B	1	Stabilizers	Including antioxidants, radical scavenger, UV absorber, etc.
	2	Surface Active Agents	Including antistatic agent, defogging agent, dispersion agent, emulsifier, etc.
	3	Slipping Agents	Including mold release agent, organic anti-blocking agent, wax, rosins, etc.
	4	Fillers	Including inorganic anti-blocking agent, inorganic colored filler, etc.
	5	Foaming agents	Including foaming adjuvant.
	6	Misc.(1) Org. substances	
	7	Misc.(2) Inorg. substances	
	8	Natural org. substances	Starch, cellulose, wood powder, etc
	9	Colorants	Including organic pigment, dye, masking agent, food colorant, inorganic pigment, etc
C		Other substances	Total amounts of resin (Class A) and natural organic substance (Class B-8) which may be used for them are 50.0 wt%(vol%) or more and mixed with additives (Class B)

[PL Classification Flow]



(5) Rules for listing, addition, revision and deletion are prescribed below.

2. Rules Regarding Listing

(1) Positive List (PL) is to be compiled following the Policy for Positive List.

(2) A substance may be selected when it meets one or more of the conditions given below.

a) Under the biodegradability tests (OECD 301C, JIS K 6950 = ISO 14851, JIS K 6951 = ISO 14852, JIS K 6953 = ISO 14855) designated by the Committee, one component product intended for PL is to show of the maximum rate (%) of degradation with 60 per cent or more.

b) Under the oral acute toxicity test, LD_{50} is to be 2,000mg/kg or more

c) It is no specified chemical substance under Article 2, Paragraph 1 of [the Law regarding Examination and Regulation of Manufacture, etc. of Chemical Substances (Be abbreviated to the Chemical Substances Control Law)](1973 Law # 117)

d) It is not a substance being forbidden to manufacture under the latest version of the Law Regarding Industrial Safety and Hygiene.

(3) Polymeric substance with molecular weight of Mn1,000 or more is classified as resin (Class A), and the other chemical is classified as additive (Class B(1～9)) following its intended use.

(4) Under Clause (2)-a), multi-component product intended for PL or fabricated plastic product (finished product) are to disclose all components of the product intended for PL and it is to be proven that each component is to comply with the Committee's Rules Regarding PL Listing.

(5) Under Clause (2)-a), natural organic substances and inorganic substances (including natural inorganic substances) are excluded. However, these substances are limited to those being used in addition to resin (Class A). Besides, amounts of addition (use) of inorganic substances are to be less than 50 per cent of total weight (resin plus all additives).

(6) In place of Clause (2)-b), if it is confirmed that LD_{50} is 300mg/kg and that any LC_{50} of designated environmental ecotoxicological tests (algae, Daphnia, fish) is 100 mg/l or more, it is approved to be in compliance.

(7) Under Section (2), those complying with the following regulations can omit some item.

① It is allowed for organic additive (Class B) not to comply with Clause (2)-a),

provided that it is used in addition to resin (A class) and that a weight content ratio of any additive component versus total weight (resin plus all additives) is less than 1 per cent.

② Total amounts of organic additives that are allowed not to comply under ① are to be at their rate of weight content of less than 5 per cent against total weight (resin plus all additives).

③ Substances, that are approved as (direct) food additives in Japan and USA, are approved as safe substances to comply with Clause (2)-b) and may be listed on PL, provided that they have technical effects in manufacture and fabrication.

④ A resin (Class A) has a molecular weight distribution. If it is confirmed that the resin with the largest average molecular weight complies with Clause (2)-a), it is approved that the resin with less average molecular weight complies with Clause (2)-a).

(8) On the assumption that a resin (Class A) is degraded under natural environment, the information supporting safety of degraded products (intermediates) generated by degradation is to be presented to the Committee.

(9) Colorants are limited to those being not regulated by the latest version of "the Self-imposed Regulations Regarding Printing Inks for Food Packaging Substances (NL Regulation)"(Enacted in April 1973) of the Printing Ink Industry Federation.

(10) Other substances (Class C) mean raw materials whose main components (Class A) are resins to comply with Clause (2) and (8) and whose minor components are additives (Class B) to comply with Clause (2) or Clause (7)-①②③, and those including 50.0 weight per cent (or 50.0 volume per cent) or more of total amounts of the resins (Class A) and natural organic substances (Class B-8).

3. Rules Regarding Amendment and Addition to Positive Lists

(1) Positive Lists (PL) may be amended or added in accordance with the Policy for Positive List and the Rules for Positive List.

(2) Regular, Supporting and Mark members of the Biodegradable Plastics Society may file an application for amendment or addition to the Positive List in accordance with the following procedures.

① To add a new substance being not listed on the Positive List, a completed Form A is to be filed with necessary attachments to the Chairperson of the Identification and Labeling Committee.

② To amend a description of a substance being listed on the Positive List, a completed Form A is to be filed with necessary attachments to the Chairperson

of the Identification and Labeling Committee. In the item 6 "Current Certificate" of the Form A, such contents of the certificate as [PL class (to be filled out to a Certification Criteria column), Certified Date and Effective Period] are to be filled out.

③ To add a substance being not listed on the Positive List but being certified as biodegradable plastics by a foreign organization for certification, a completed Form A is to be filed with necessary attachments to the Chairperson of the Identification and Labeling Committee. In the item 6 "Current Certificate" of the Form A, such contents of the certificate as Name of Certificate, Name of Country for Certification, Certified Date and Effective Period, and, in a Form B, contents of Criteria for Certification are to be filled out.

④ To add other product composed of materials (substances) being listed on the Positive List, a completed Form C, which is to disclose all components, with necessary attachments to the Chairperson of the Identification and Labeling Committee.

(3) In application of a resin (Class A), to attach to the application form information (copies of test reports, literatures, general remarks, etc.) on characteristics or safety of degraded products (intermediates) that generate from the resin in natural environment. (Refer to a MITI consigned study report: A study on safety of biodegradable plastics by the Japan Bioindustry Association)

(4) As for tests designated by the Committee in PL application, refer to an attached document "About test methods necessary for PL listing".

References

Annexed material: Format A~C

Attached material: About test methods necessary for listing on PL (April 2000)

Separate material: MITI consigned report: A study on safety of biodegradable plastics by the Japan Bioindustry Association

4. Rules Regarding Deletion

In the following cases, a substance is to be deleted from the Positive List by following the procedures prescribed separately.

(1) When the substance concerned can not satisfy the conforming conditions as a result of alteration of the Rules Regarding Positive List by the amendment of the referred regulations.

(2) When the safety of a substance becomes an object of public concern and the substance is judged to delete considering the social circumstances.

(3) When it is judged that the finished product concerned is hardly recognized as biodegradable product, because biodegradability of a substance can not govern biodegradability of the finished product using the substance.

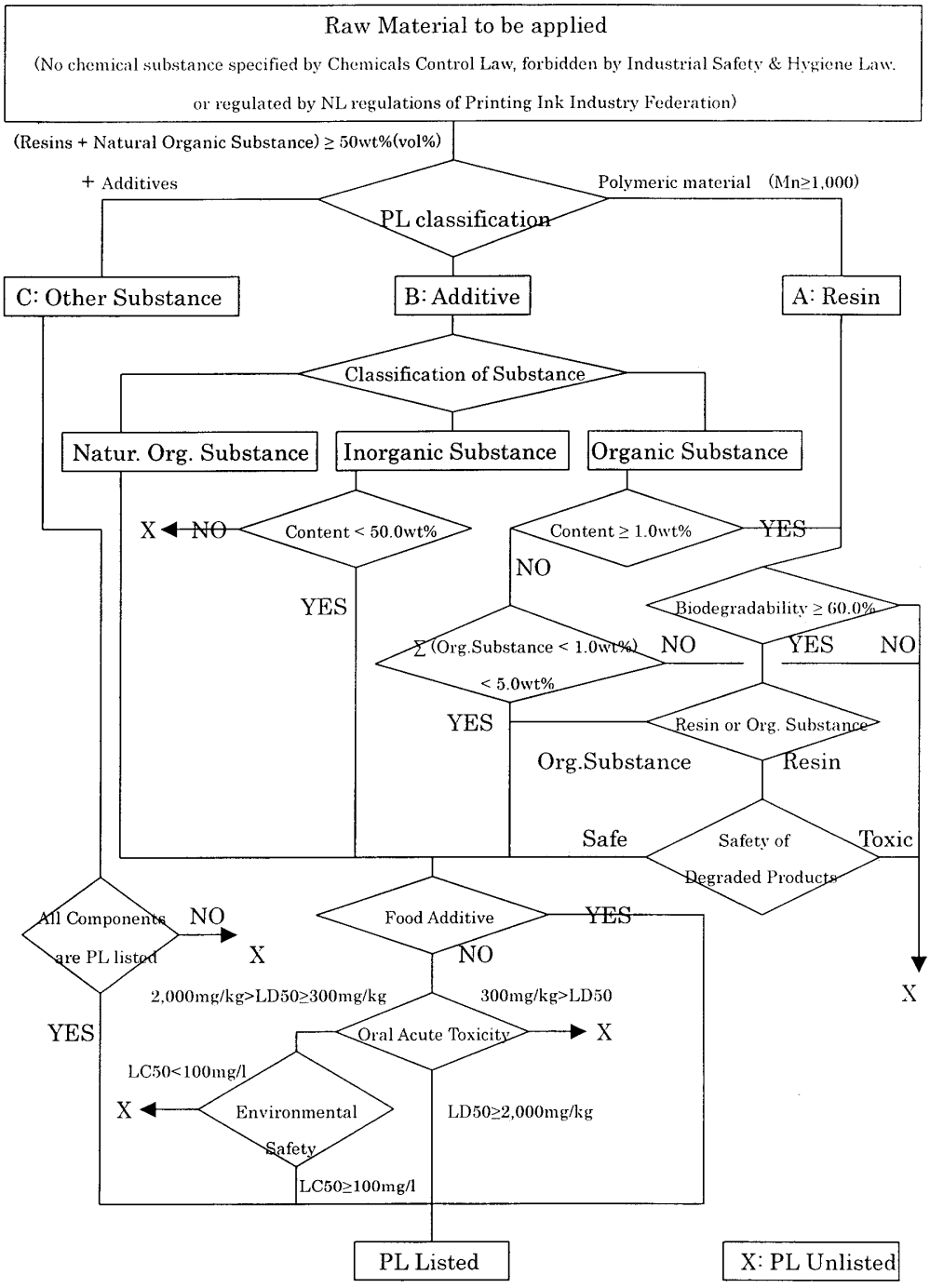
(4) When it is judged that characteristics of a substance are different from the contents of application for Positive List, and that the substance can not satisfy the Rules for Positive List laid down by the Biodegradable Plastics Society.

(5) When it is found that a substance does not have a code number given by the prescription in Article 4, Item 1 (About the Results of Judgement on New Chemical Substances) of Law Regarding the Examination and Regulation of Manufacture, Etc. Chemical Substances (Law No. 117, 1973). However, it is not a case when a copy of the written confirmation by Ministers of Health and Welfare and of International Trade and Industry following Article 4 of Ministerial Ordinance Regarding Registration, Etc. of Manufacture or Import of A New Chemical Substance (Ministerial Ordinance of Ministry of International Trade and Industry No.1, 1974) is submitted.

(6) In addition to the above, when it becomes clear that a substance is not actually used.

5. Raw materials conforming to PL

It is confirmed from the following flow chart if a raw material to be applied can be listed on PL or not.



附　錄　八

考察團全體團員名單及活動剪影

U.S. GRAINS COUNCIL

Certification System of Bioplastic Team (August 7-15, 2003)

Mr. Yung-Chiech Yu

Executive Secretary of
Recycling Management
Foundation,
Environmental Protection
Administration

尤泳智
資源回收基金會執行秘書
行政院環境保護署

Dr. Chiu, Ning Yu

President,
Environment and
Development
Foundation

于寧
總經理
環境與發展基金會

Dr. Chien-Ming Huang

Chairman,
Environmentally
Biodegradable Polymer
Association

黃建銘
理事長
環保生物可分解材料協會

Dr. Hsiu-Ping Pearl Lin

Director for Environmental
Biotechnology,
Development Center of
Biotechnology

畢修平
環境生物技術專案主持人
生物技術開發中心

Mr. Yao-Kuei Hsiao

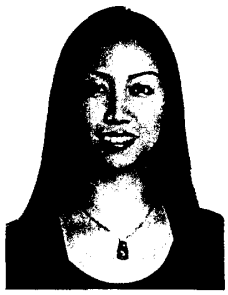
Vice General Manager,
Plastic Industry
Development Center

蕭耀貴
副總經理
塑膠工業技術發展中心

Miss Li-Ya Lilian Lai

Assistant Manager
of Overseas
Marketing Dept.,
Wei Mon Industry Co., Ltd.

賴麗雅
國外業務部副理
偉盟工業股份有限公司



Mr. Min-Huang Lin

General Manager,
Power Source &
Associates Corp.

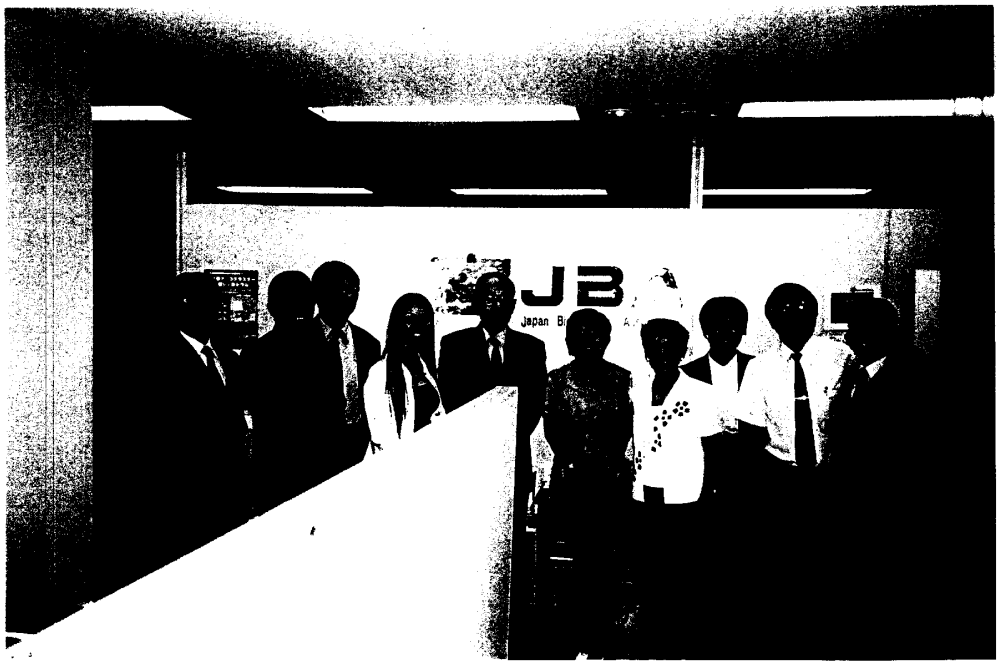
林明煌
總經理
旭農生物資源股份有限公司

Mr. Clover S.Y. Chang

Assistant Director
of Taiwan Office,
U. S. Grains Council

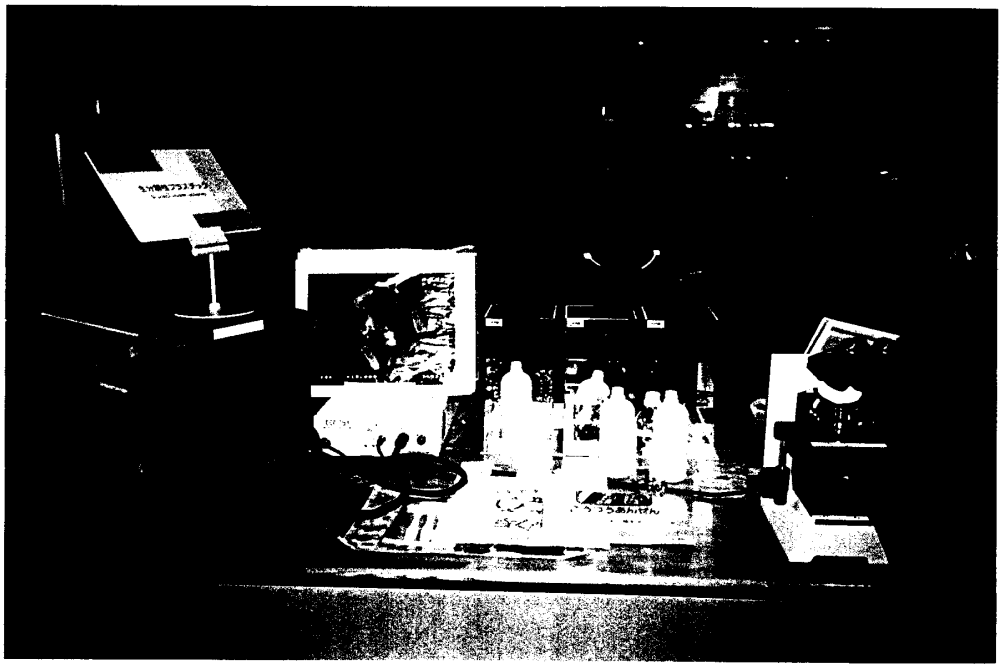
張學義
駐台副代表
美國穀物協會

八月八日拜訪美國穀物協會日本東京辦事處與該處副代表坂下洋子(Hiroko Sakashita)(右四)合影

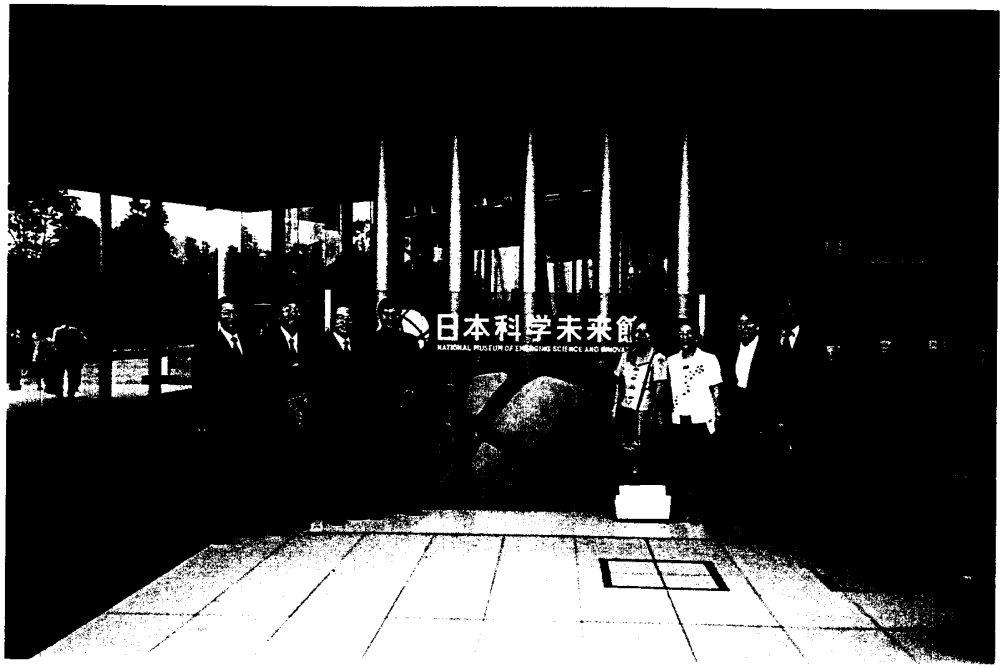


拜訪日本生物可分解協會(JBPS)與該會理事長大島一史(Dr. Ohshima Kazushi)(右六)合影

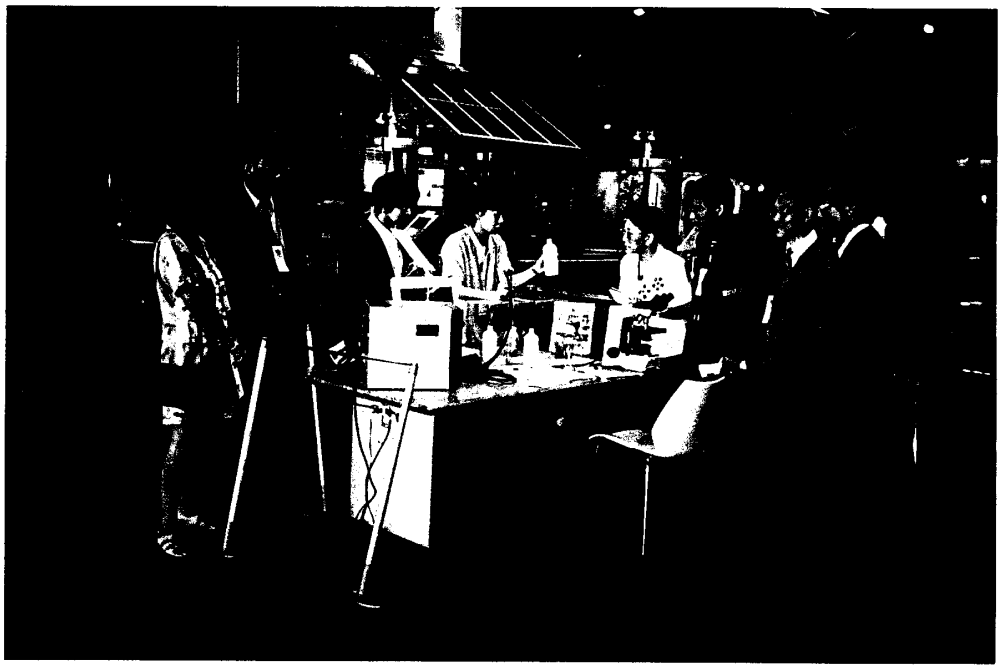
拜訪日本有機資源協會(JORA)時，本團團長環保署
執行秘書尤泳智(左三)代表致贈紀念品情形



日本科學未來館內展示各種生物可分解塑膠之驗證儀器



八月八日參觀「日本科學未來館」時在館前留影



在「日本科學未來館」內參觀生物可分解塑膠產品之展示及檢驗情形

八月十二日在美國科羅拉多州丹佛市參加第十一屆生物可分解塑膠國際研討會時，全體團員在會場合影

參加研討會中與美國穀物協會日本東京辦事處代表Cary B. Sifferatn(右五)合影

參加研討會時，在論文發表海報展示場前留影

在研討會中與德國 ISD INTERSEROH 代表 Joran Reske 經理(右四)
共同研商如何推展生物可分解塑膠之驗證事宜

附錄九

參加第十一屆生物可分解塑膠國際研討會名單

11th Annual BEPS Attendee List
August 10 - 13, 2003; Denver, CO USA

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11th Annual BEPS Attendee List
August 10 - 13, 2003; Denver, CO USA

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