ENVIS Newsletter

Publication of

UTTARANCHAL ENVIRONMENT PROTECTION AND POLLUTION CONTROL BOARD

Website : www.ueppcb.org

Issue II March 2007

Plastic Waste Management Initiatives in Uttaranchal State

Vibha Puri Das
IAS
Principal Secretary,
FRDC & Chairperson

Message

The aim of UEPPCB is not restricted to pollution control rather its aim is to educate and facilitate information flow on environmental issues as a part of promotional activities. However the plastic has bacame the integral part of our life, but improper disposal of plastic after its use can have direct and indirect health impact as well as potential threat to the environment and public in general. The present ENVIS document is dedicated to plastic waste management and initiatives taken in Uttarakhand.

I do hope that the publications of this document will receive the attention which is due for it.

1.0 Background

According to the known facts, the plastics industry really began in 1868. A young American printer, named John Wesley Hyatt, was searching for a new material to be used as a substitute for ivory in the making of billiard balls. He found that cellulose nitrate, formed by the action of nitric acid on cotton cellulose, mixed with camphor and treated with proper amounts of pressure and heat, produced a substance that could be molded into desired shapes. He called his new material celluloid. In the beginning of twentieth century, a second plastic was produced. Adolph Spitteler, a German, mixed sour milk and formaldehyde together to form a material, which was really a casein plastic. In 1909, Dr. Leo Baekeland, an American born in Belgium, was trying to produce a synthetic resin. He did this successfully by mixing phenol and formaldehyde together under certain conditions, thus producing the first synthetic resin. Indeed, the word plastic comes from the Greek word 'plastikos', meaning moldable.

2.0 CLASSIFICATION OF PLASTIC

Plastics, depending on their physical properties, may be classified as thermoplastic and thermosetting materials. Thermoplastic materials are formed into desired shapes under heat and pressure and become solids on cooling. If they are subjected to the same conditions of heat and pressure, they can be remolded. Thermosetting materials acquire infallibility under heat and pressure and cannot be remolded. The plastics are classified also according to their chemical sources. Four general groups of plastics are:

- Cellulose plastics include the cellulose nitrates and cellulose acetates. The cellulose nitrate plastics are the oldest in this group, and "Celluloid" is the oldest example. These plastics are made from cotton or wood pulp.
- Synthetic resin plastics include the phenol formaldehyde, urea formaldehyde, vinyl, styrene, and acrylic plastics. These plastics are made from phenol, formaldehyde, urea, acetylene, petroleum, glycerol, and phthalic anhydride.
- Protein plastics--casein plastics are the most common type in the protein group. They are made from milk. Other protein plastics are made from soy beans, coffee beans, peanuts, and other agricultural products.
- Natural resins include shellac, asphalt, rosin, amber, and pitch. These materials with fillers are usually cold-molded.

The major chemicals used to make plastic resins pose serious risks to public health and safety. Many of the chemicals used in large volumes to produce plastics are highly toxic. Some chemicals, like benzene and vinyl chloride, are known to cause cancer in humans; many tend to be gases and liquid hydrocarbons, which readily vaporize and pollute the air. Many are flammable. Even the plastic resins themselves are flammable and have contributed to numerous chemical accidents. The production of plastic emits substantial amounts of toxic chemicals (eg. ethylene oxide, benzene and xylenes) to air and water. Many of the toxic chemicals released in plastic production can cause cancer and birth defects and damage the nervous system, blood, kidneys and immune systems. These chemicals can also cause serious damage to ecosystems. Some of the major players involved in manufacturer and their uses is shown in Table 1:

S.No.	Players	Uses
1.	Polystyrene	"Styrofoam"Many food containers for meats, fish, cheeses, rigid plates, packaging "peanuts," foam packaging, audio cassette housings, CD cases.
2.	PVC (polyvinyl chloride)	PVC is used for many products including: flooring, toys, teethers, raincoats, shoes, building products like windows, siding and roofing, hospital blood bags, IV bags and other medical devices. One of it's major ingredients is chlorine. When chlorine-based chemicals are heated in the presence of hydrocarbons they create dioxin, a known carcinogen and endocrine disruptor. All PVC production releases dioxin
3.	Polyethylene	Hexachloroethane is one chemical used as an initiator in the formation of polyethylenes. Hexachloroethane has a variety of applications as a polymer additive. It has flame-proofing qualities, increases sensitivity to radiation and it is used as a vulcanizing agent. Added to polymer fibers, hexachloroethane acts as a swelling agent and increases affinity for dyes. Hexachloroethane may emit tetrachloroethylene, carbon tetrachloride, and chlorine when thermally decomposed.
4.	Phthalates	Softened vinyl products manufactured with phthalates, Vinyl clothing, Footwear, Printing inks, Non-mouthing toys and children's products, Product packaging and food wrap, Vinyl flooring, Blood bags and tubing, Surgical Gloves, Breathing tubes.
5.	HDPE (High Density Polyethylene)	Fishing net, ropes, tapes, fuel tanks, small/medium/large containers, containers for detergent, cosmetics, pharmaceutical products shopping bags, general purpose industrial packaging materials.
6.	LDPE (Low Density Polyethylene)	Heavy-duty wrapping film, general purpose wrapping, thin films, agricultural films for greenhouse application, protective films, gel free films for lamination, packaging materials automobile interiors, thermal insulation sheets, food containers.
7.	PET (Polyethylene Terephthalate)	Soda and water bottles

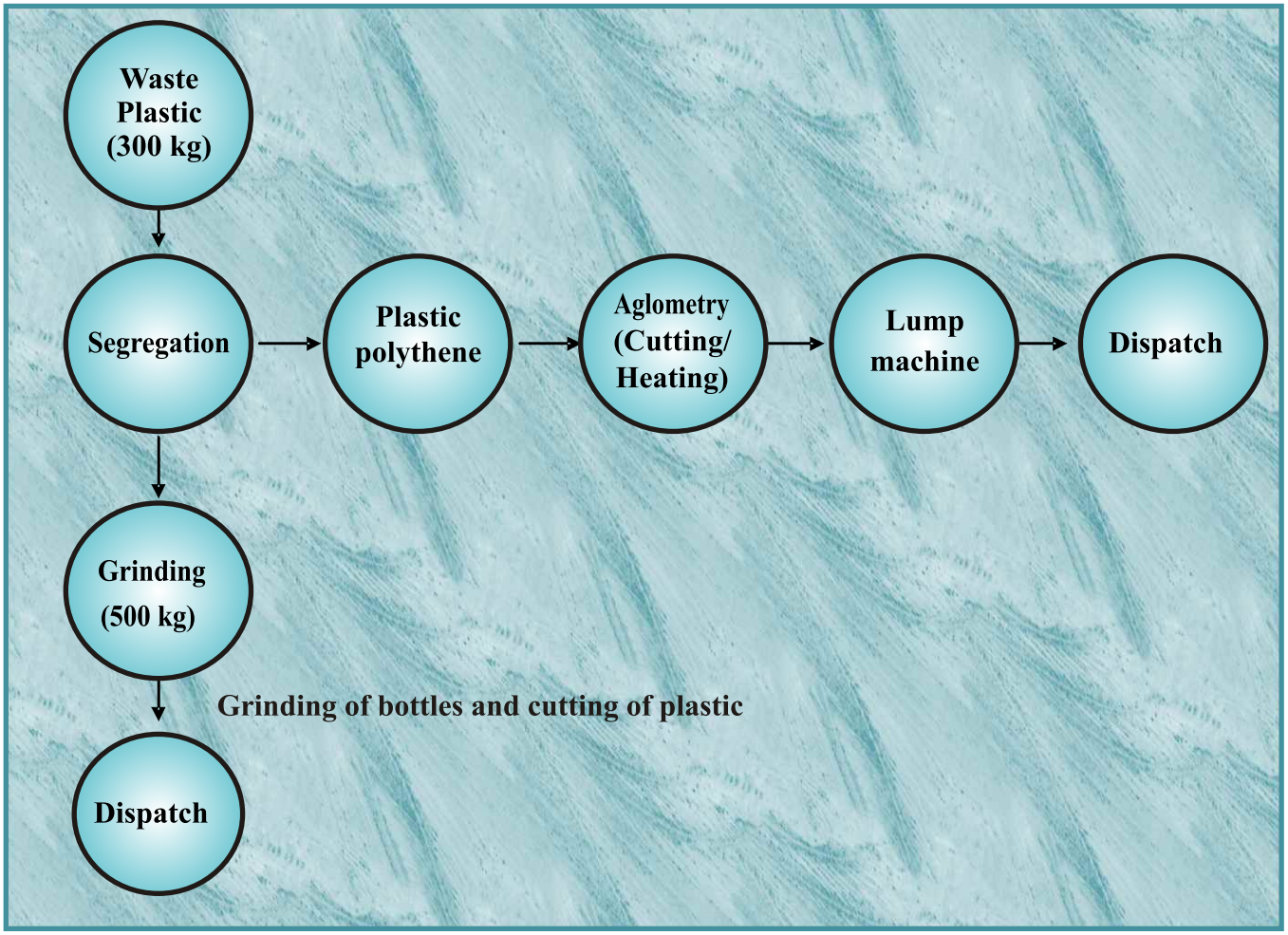
3.0 PLASTIC DENSIFICATION PROCESS

Mechanical recycling is the process in which the plastic are, reformed into moulding granules to make new products. This process is known as plastic densification. The process involves collection, sorting and then size reduction into flake or granules which may then need washing and drying. This is then re-compounded with additives and/or more virgin raw material, extruded and chopped into pellets ready for reuse. In Uttaranchal state, plastic densification plant has already been established in Srinagar, Garhwal where waste plastic collected from Char-Dham routes are being densified and sent to plastic recycler units.

4.0 THE BASICS OF PLASTIC MANUFACTURING PROCESS

The term "plastics" comparises of organic materials, such as the elements of carbon (C), hydrogen (H), nitrogen (N), chlorine (Cl) and sulfur (S), which have properties similar to those naturally grown in organic materials such as wood. Organic materials are based on polymers, which are produced by the conversion of natural products or by synthesis from primary chemicals coming from oil, natural gas or coal.

The plastic manufacturing process begins by heating the hydrocarbons in a "cracking process."



Here, in the presence of a catalyst, larger molecules are broken down into smaller ones, such as ethylene (ethene) C_2H_4, propylene (propene) C_3H_6, and butene C_4H_8 and other hydrocarbons. The yield of ethylene is controlled by the cracking temperature and is more than 30% at 850^{0}C and such products as styrene and vinylchloride can be produced in subsequent reactions. These are then the starting materials for several other types of plastics. Therefore, this process results in the conversion of the natural gas or crude oil components into monomers such as ethylene, propylene, butene and styrene.

These monomers are then chemically bonded into chains called polymers. Different combinations of monomers yield plastic resins with different properties and characteristics. Each monomer yields a plastic resin with different properties and characteristics. Combinations of monomers produce co-polymers with further property variations.

The resulting resins may be molded or formed to produce several different kinds of plastic products with application in many major markets. The variability of resin permits a compound to be tailored to a specific design or performance requirement. This is why certain plastics are best suited for some applications while others are best suited for entirely different applications.

4.1 The Additives

When plastics emerge from reactors, they do not have the desired properties that make it a material of choice. In order to achieve a commercial product, the plastic is subject to further treatment and the inclusion of additives which are selected to give it specified properties. Most polymers are blended with additives during raw material processing into their finished parts. Additives are incorporated into polymers to alter and improve their basic mechanical, physical or chemical properties. Additives are also used to protect the polymer from the degrading effects of light, heat.

4.2 Types of Additives:

- antioxidants: for outside application
- colorants: for colored plastic parts
- foaming agents: for styrofoam cups
- plasticizers: used in toys and food processing equipment

4.3 Processing Methods

There are a variety of different processing methods used to convert resins into finished products. Some include:

4.3.1 Extrusion

This continuous process is used for the production of semi-finished goods such as films, sheet profiles, tubs and pipes. They are termed "semi-finished" because they must be further processed before they become useful articles. Plastic material is first loaded into a hopper and then fed into a long heated chamber through which it is moved by the action of a continuously revolving screw. At the end of the heated chamber, the molten plastic is forced out through a small opening called a die that is cast in the shape of the finished product. As the plastic extrusion comes from the die, it is fed onto a conveyor belt where it is cooled by blowers or by immersion in water. Examples of products include lawn edging, pipe, film and window trim.

4.3.2 Injection molding

Since this process can produce moldings of high quality and with great accuracy, it is very widespread. It is predominately used for thermoplastics but smaller amounts of thermosets and elastomers are also processed by this way. In injection molding, plastic material is also put into a

hopper, which feeds into a heating chamber. A plunger pushes the plastic through the heating chamber where the material is then softened into a fluid state. At the end of this chamber, the resin is forced into a closed mold. Once the plastic cools to a solid state, the mold opens and the finished product is ejected. This process is used to make such items as butter tubs, yogurt containers, closures, fittings and razors.

4.3.3 Blow molding

Blow molding is a process used in conjunction with extrusion. The die forms a molten tube of thermoplastic material. Using compressed air, the tube is then blown to conform to the interior of a chilled mold which clamps around the tube. Overall, the goal is to produce a uniform melt, form it into a tube with the desired cross section and blow it into the exact shape of the product. This process is intended for use in manufacturing hollow plastic products and its principal advantage is its ability to produce hollow shapes without having to join two or more separately molded parts. This method is used to make items such as commercial drums and bottles.

4.3.4 Rotational Molding

This process is relatively simple in concept since heat is used to melt and fuse a plastic resin inside a closed mold without using pressure. Rotational molding consists of a mold mounted on a machine capable of rotating on two axes simultaneously. Solid or liquid resin is then placed within the mold and heat is then applied. Rotation distributes the plastic into a uniform coating on the inside of the mold until the plastic part cools and sets. This process is used to make hollow configurations. Common rotationally molded products include shipping drums, storage tanks and some consumer furniture and toys.

5.0 DEGRADABLE PLASTICS

A number of UK retailers have recently introduced degradable carrier bags. These bags are made from plastic which degrades under certain conditions or after a predetermined length of time. There are two types of degradable plastic: bio-degradable plastics, which contain a small percentage of non oil-based material, such as corn starch; and photodegradable plastics, which will break down when exposed to sunlight.

Degradable plastics are already being used successfully in Austria and Sweden. This enables all catering waste to be composted without segregation. Carriers for packs of beer cans are now being manufactured in a plastic which photo-degrades in six weeks.

There are a number of concerns over the use of degradable plastics. First, these plastics will only degrade if disposed of in appropriate conditions. For example, a photodegradable plastic product will not degrade if it is buried in a landfill site where there is no light. Second, they may cause an increase in emissions of the greenhouse gas methane, as methane is released when materials biodegrade anaerobically.

6.0 CONCEPT OF SAY "NO" TO PLASTIC CARRY BAGS

Thin plastic carry bags has become an intrinsic part of our lives. It is one of the most ignored environmental and health problems. Almost everyone including chemists, grocers, vegetable/fruit vendors, restaurants, fast food centers, and super markets, put everything we buy in plastic carry bags, as they find it cheaper easier and cleaner to get them. The colourful plastic carry bags can be seen littered around carelessly they cause more harm when they are strewn allover. But people unmindful of their hazardous nature, are liberally accepting plastic

bags and discarding them all around carelessly.

Being, non- biodegradable, they chocke the earth for hundreds of years, making the soil unfertile, a part from polluting ground water through leaching of toxic substances. They choke open drains, sewer lines. The carcinogens-the agents which cause cancer is likely to be generated during chemical reaction that take place in plastic materials, inter alia due to temperature variations. They are reported to enter human body, througth food items like sambar pickles fatty or liquied items packed in non food grade and coloured plastics bags. The regular intake of such food items containing carcinogens, is very hazardous to health over a period of time. Though there may not be any immediate effect on health it would be too late, once the effects of carcinogen start showing up.

In the light of environmental, health risks, the cost factors and other problems involved in the management of domestic plastic wastes, it is desirable to reduce the quantum of waste generated, by minimizing the use of plastic carry bags and by reusing them in our daily lives. This can be achieved by increasing the thickness of carry bags, so as to make them expensive and to discourage their liberal dispension, use and disposal. Then whatever is discarded will be collected by the rag-pickers because of their high value realization.

7.0 THE PLASTIC MANUFACTURE, SALE AND USAGE REGULATION IN INDIA

In order to regulate the manufacturer, sale , distribution and use of recycled plastic carry bags and recycle plastic containers, Govt. of India has promulgated the " Plastic Manufacturer, Sale and Uses Rules 1999". Following are the silent features of the rules:

7.1 Prescribed Authority

a) The prescribed authority for enforcement of the provision of these rules related to manufacture and recycling shall be the State Pollution Control Boards in respect of States.

b) The prescribed authority for enforcement of the provisions of these rules related to the use, collection, segregation, transportation and disposal shall be the District Collector/Deputy Commissioner of the concerned district where no such Authority has been constituted by the State Government/ Union Territory administration under any law regarding non-biodegradable garbage.

7.2 Restriction on manufacture, sale, distribution and use of virgin and recycled plastic carry bags and recycled plastic containers:-

(1) No person shall manufacture, stock, distribute or sell carry bags made of virgin or recycled plastic bags which are less than 8x12 inches (20 x 30 cms) in size and which do not conform to the minimum thickness specified in the rules.

(2) no vendor shall use carry bags made of recycled plastic for storing, carrying, dispensing or packaging of foodstuffs.

(3) No vendor shall use containers made of recycled plastics for storing, carring, dispensing or packaging of foodstuffs.

Explanation:- For the purposes of this rule, the minimum weight of 50 carry bags made of virgin or recycled plastic shall be 105 gms. Plus or minus 5% variation and the carry bags of larger sizes shall be of proportionate increase in weight.

7.3 Condition of manufacture of carry bags and containers made of plastic:-

Any person may manufacture carry bags or container made of plastics if the following conditions are satisfied, namely:-

- Carry bags and containers made of virgin plastic shall be in natural shade or white;
- Carry bags and containers made of recycled plastic and used for purpose other than storing and packaging foodstuffs shall be manufactured using pigments and colourants as per IS:9833:1981 entitled " list of pigments and colourants for use in plastics in contact with foodstuffs, pharmaceuticals and drinking water".

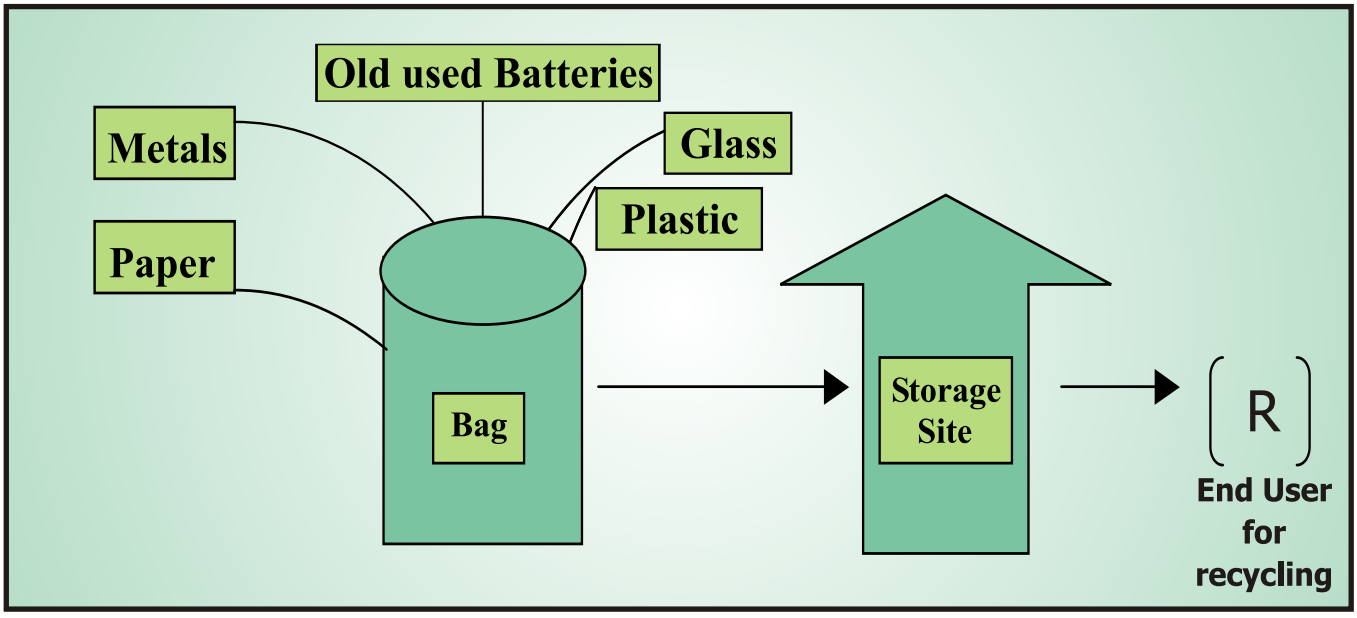
7.4 Thickness of Carry bags:- The minimum thickness of carry bags made of virgin plastic or recycled plastic shall not be less then 20॰

7.5 Recycling:-

Recycling of plastics shall be undertaken strictly in accordance with the Bureau of Indian Standards specification IS:14534:1998 entitled "The Guidelines for Recycling of Plastic".

In general the non-biodegradable waste including plastic waste shall be kept segregated at source of generation e.g. at home. Some of the non-biodegradable wastes to be used for recycling purpose are as follows:

- Waste Plastic
- Paper, plastic cover
- All types of polythene covers
- Wooden things
- Bottles, waste cloth
- Old chappals
- Mineral water bottles
- Electric wire
- Leather items
- Old used batteries
- Fused bulbs

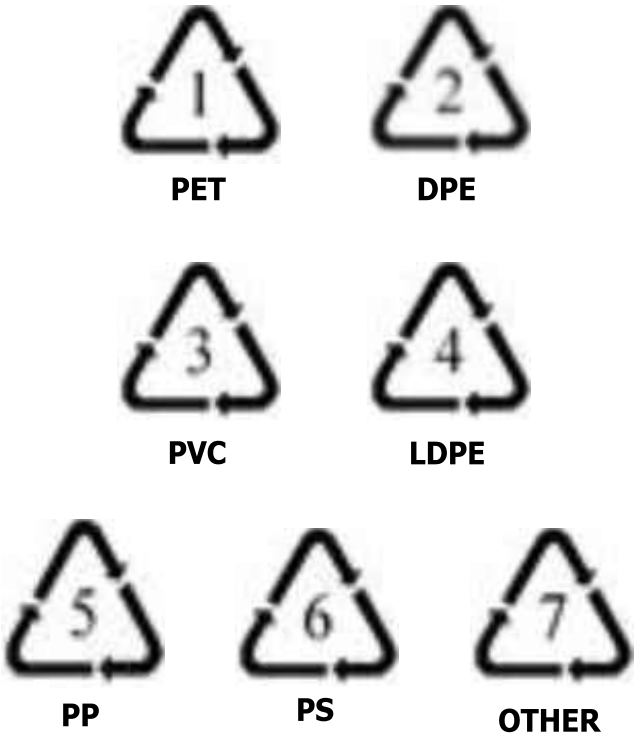


- Rubber items
- Empty paste tubes

The modus operandi for collection of non-biodegradable waste at source is shown in figure.

7.6 Identification of Plastic End Product

1. The manufacturers of plastics end products from either virgin or recycled plastics shall mark the symbol at the time of processing in order to help the reprocessor to identify



the basic raw material. The symbols defined by Society of the Plastics Industry (SPI), USA are as follows:

While marking the symbol 7, the respective basic raw material like ABS, PPO, PC, PBT, etc and mixed shall be indicated below the symbol.

2. In addition to the symbol indicated, the end product made out of recycled/ reprocessed plastics, wherever possible shall be marked with 'Recycled indicating percentage of use of recycled material'.

Example:' This product contains 20 to 30 percent post consumer recycled plastics'

Alternatively, the following codification shall be used

RO- No recycle/reprocess, R1- Less than 10 percent, R2- 11 to 20 percent, R3 - 21 to 30 percent, R4- 31 to 40 percent, R5- 41 to 50 percent, R6- 51 to 60 percent, R7- 61 to 70 percent, R8- 71 to 80 percent, R9- 81 to 90 percent, R10- over 90 percent

2.1 The following information shall also be printed bilingually, English/Hindi and local language wherever possible on the end-product for the benefit of users/reprocessors.

2.2 This product (like carry bags/ shopping bags, bottles, blow-moulded containers, etc) is made of (indicate materials) and is reusable/recyclable.

However, carry bags/containers made out of recycled plastics shall be labeled as **'Not suitable for packing/ storing/carrying food products.'**

8.0 INITIATIVES TAKEN BY UTTARANCHAL ENVIRONMENT PROTECTION & POLLUTION CONTROL BOARD

1 Under the awareness programme Uttaranchal Pollution Control Board has launched plastic waste collection competition in all the Districts of states on

	the occasion of World Environment Day 2004. The summery of total plastic waste collected in different Districts is shown in Table	
S.No.	**District**	**Quantity of plastic waste collected (Kg)**
1.	Pithoragarh	250
2.	Rudrapriyag	1275
3.	Tehri Garhwal	6484
4.	Uttarkashi	602
5.	Almora	251
6.	Chamoli	210
7.	Dehradun	11473
8.	Haridwar	2157
9.	Nainital	407
10.	Pauri	1000
	Total	**24109**

2. In the same line, on the occasion of World Environment Day 2006, a week long plastic waste collection drive organized in Dehradun City in association with Nagar Nigam, Dehadun, and local rag pickers. The total of 1200 Kg waste plastic collected.

3. The Govt. of Uttaranchal has established one plastic densification plant of 300kg/hour capacity at Srinagar, Garhwal, where waste plastic collected from Char-Dhaam routes are mechanically reformed into small granules/ flakes and then being send to recyclers.

4. In order to facilitate collection, storage and segregation of plastic, the state Govt. has allotted land to the private agencies for storage and segregation of wastes at one place and after segregation plastics are send to recyclers of other states.

The Uttaranchal Board has finalized the "Uttaranchal plastic and other non biodegradable waste", "uses and disposal" act which is under consideration of state

Plastic waste collection week inaugurated by Member Secretary, UEPPCB, Dehradun

Waste Plastic collected for densification process

Densification equipment

Processing of pet bottles

Densified wastes plastic

Densified waste plastic ready for dispatch

Plastic Waste Densification Plant at Srinagar, Garhwal

ENVIS QUERY FORM

To Review the effectiveness of ENVIS News Letter, We Request you to fill up the Query Form and send it to us.

Do you receive the ENVIS News Letter regularly, as it is published? Yes/ No

Do you find it informative on the broader subject area Yes/ No

Any Suggestion / Comments on ENVIS News Letter?

Any Query related to ENVIS News Letter-

Name-

Address-

Phone/Fax/e-mail (If any)-

ENVIS Centre

Uttaranchal Environment Protection and Pollution Control Board, Dehradun

Published by
ENVIS CENTRE

Uttaranchal Environemnt Protection
& Pollution Control Board
Paryavaran Bhawan,
E-115, Nehru Colony, Haridwar Road,
Dehra Dun, Uttaranchal (India)
Ph. : 0135 - 2668922
Fax : 0135 - 2668092
Email : ueppch_ddun@yahoo.co.in

Printed at : Microsoft Technoprint (I) Pvt. Ltd. Ph.: 0135-2715092