HARMFUL EFFECT OF PLASTIC IN ANIMALS

Bhupendra Singh, III/ 1, Ramganga Colony, Dhampur, Distt. Bijnor (UP)

Harmful Effects

The coming known examples of hazardousness produced by plastics define that only some of plastics are responsible for that - Mainly polyethylene and Polyvinyle chloride because both of these two are using for food grade applications at very large scale.

Epidemiology

Though, there is no such systematic study on polythene and plastic induced pathological lesions in animals. However, there are scattered reports in literature and that too in popular media. An attempt is made to collect information from various sources and present in a consolidated form.

1. Five cows were choked to death in Jaipur due to blockage of their digestive tract following consumption of polythene bags.

2. Two cows were operated and 48 kg of polythene and 287 foreign bodies were recovered from rumen/ reticulum of the cows by Veterinary Surgeons in Jammu.

3. On an average about 25 cases were recorded each year in polyclinic of CCS HAU, Hisar, which were operated to remove the polythene from stomach of cows. It is believed that there are much largers numbers of stray animals which after conserving polythene simply end up in death.

4. As per the Greek publication plastic bags kill 10,000 Mediterranean fish each day.

5. It has been recorded that 95% of urban stray cattle in India suffering from various ailments due to hazardous material inside their abdomen, out of them 90% are plastic bags.

6. Plastic bags are major cause of unsightly litter and also harm wildlife like deer etc. In a report, polybezoars containing polythenes and plant materials along with salt deposits were found in stomach of a barking deer which comprises into 3 pieces each measuring 4-5 cm in diameter and hard to touch. It was found responsible for blocking of rumeno-reticulum opening leading to death of barking deer.

7. Plastic bags that end up at sea are easily swallowed by marine life that mistake them for food. An estimated 1,00,000 whales, seals, turtles and other marine life die every year after swallowing plastic bags.

8. A seriously ill cow was operated in Bhuj by a Veterinary Surgeon and about 4000 plastic bags were found in stomach with other non-digestible waste.

9. In Delhi zoo, a Swamp deer and a Sangai deer died due to plastic bags.

10. SPCA Veterinarian operated more than 15 cows and found about 10 kg plastic waste in stomach of each cow.

Pathogenesis

The dairy and cattle owners are responsible for the plights of cows after milking them in the morning. They allow the cows and virtually push them out of shelters to find food available in dumps of debris lying around the city.

Stray cows are generally seen on the roadsides eating away the plastic bags and their contents in search of food items.

The ingested polythene hinders the process of fermentation and mixing of contents leading to indigestion. They also obstruct the orifice between reticulum and omasum. If not removed though surgery, polythenes may become fatal. The plastic bags cannot be digested or passed as such through faeces by an animal. They stay in the gut causing pain and death. When dead animal decay, the bags are freed and often eaten again by other animals and this cycle may continue for many years to come. Marine animals often mistake them for jellyfish and eat them. The birds are many times entangled in plastic bags who cannot fly then and die of starvation.

The toxic contents of plastic may also enter in man through milk produced by such cows. The foreign bodies like hard metal needles, wires, nails, etc. are also disposed alongwith other house waste in polythene bags, which after consuming by cows may settle in reticulum giving rise to a condition “tranmatic reticulo pericarditis (TRP)”. One can see many stray cows found on roadsides with TRP where in their foreleg portion is found swollen.

Pathology

Various pathological conditions are encountered due to plastic and polythene in animals.

1. Indigestion: The polythenes and other plastic material do not degrade in rumen/ reticulum and remain as such causing hindrance in orifice. When it is mixed with feed, the ingredients are also trapped in between polythenes which becomes tight due to ruminal movements. This whole process also affects the rumen microflora leading to indigestion of feed.

2. Impaction: Rumen becomes impacted due to presence of large quantities of polythene bags/ plastics in rumen accumulated over a period of time. This leads to rumenatony and decrease in rumen motility.

3. Tympany: When polythenes present in rumen and reticulum, they partially or completely occlude the orifice of reticulum and omasum leading to accumulation of gases in rumen. The situation becomes worsen if such animal is fed with legumes or other gas forming feed/ concentrates. Accumulation of gases in rumen give rise to bloat or tympany which becomes fatal, if the gases are not properly removed. Sometimes the poly bags present in rumen may also occlude oesophageal orifice leading to hindrance in eructation. This gives rise to dyspnoea and death.

4. Polybezoars: The formation of stones in digestive tract and around polythenes is known as polybezoars. In this the principal constituent is polythene and plant material, around which salts are deposited that gives rise to the formation of hard stone like mass in stomach. Such hard mass not only causes hindrance in food passage but also leads to pain and inflammation of rumen.

5. Traumatic reticulo pericarditis: Many times nails, wires or other sharp hard objects are also disposed in poly bags as waste and dropped in waste pits. From where there may eaten up by cows alongwith food/feed items and get trapped in reticulum causing damage. With the passage of time and ruminal movements sharp objects penetrate wall of reticulum and diaphragm to

invade heart leading to traumatic pericarditis. One may find many animals on streets with swollen brisket region and pain. On postmortem examination, bread and butter appearance of heart has been recorded with presence of needles/ sharp objects penetrating heart/ diaphragm through reticulum along with the presence of large quantities of polythenes in rumen and/or reticulum. Perforation of reticulum and diaphragm by foreign body and presence of adhesions are also observed.

6. Immunosuppression: It has been observed that cows with polythenes in their stomach also suffer from immunosuppression that leads to increased sensitivity to various infections particularly of haemorrhagic septicemia (Pasteurellosis). During investigation of an outbreak at Rishikesh, cows were suffering from HS during rainy season. When postmortem examination was conducted on dead cows, the rumen was found completely filled with polythenes with characteristic lesions of HS in lungs, brisket and throat region. Polythenes and plastic contain several chemicals like polyvinyl chloride, cadmium, lead, acrylamide, polyethene, etc., which are known immunosuppressants.

Besides, due to lack of proper nutrition, animal becomes weak and immunodeficient. Such animals are also prone to development of cancer. The presence of toxic chemicals may also damage epithelial lining that leads to urolithiasis particularly in kidneys.

Since there is no systematic experimental study on the effect of polythenes on livestock and/or human health, it is suggested to undertake such studies with respect to clinical pathology, histopathology and immunopathology in cattle fed with different doses, colour and types of polythenes.

Reasons for harmfulness by plastics polymeric materials.

As the name plastics comes, the picture or polyethylene comes in mind suddenly and click the various forms of polyethylene because polyethylene is famous as plastic. Generally every one think that polyethylene is plastics and plastic is polyethylene. while the actual picture is too much differ with this thought. A man when think about plastics it is 99% possible that he will be in the contact of any form of plastics at that time too. As it stands today it is impossible not only during production but also in everyday life to prevent the population from coming into contact with plastics. In any case, approximately 70 – 80 % of food is packaged in various polymeric materials.

Plastic industry contributes nearly 1/10 of toxic releases in the environment. Significant releases of toxic chemicals included:

Tri chloro ethane, Acetone, Methylene chloride, Methyl ethyl ketone, Styrene, Toluene, Benzene, 1,1,1,Trichloroethane. Other major emissions form plastics production process include sulphur oxides, Nitrous oxides, Methanol, Ethylene oxide and volatile organic compounds. Less visible but very serious is the pollution generated by producing plastic resin. As ethylene polymerized, the reactive mixture is scrubbed with dilute aquous caustic solutions that became high volume pollutants.

Unfortunately PM appear to be a potential source of the release of chemicals into the environment, they may have a variety of effects on human health as consequence of water air or

skin contamination of food. The absence of acute poisoning with fatal outcomes does not prove the safety of synthetic packaging materials. Neverthless, it must be remembered that we do not completely realize the real contribution of PM to the actual contamination of food. It is true that PM ingradients so not act like pesticides (or a variety of other highly bioactive substances) and one can hardly expect immediate and pronounced clinical manifestations of their toxic action. The occurance of acute toxicity due to PM used in contact with food and drinking water is most unlikely, since only trace quantities of toxic substances are likely to migrate. However, it would be a great underestimation to consider PM ingredients (indirect food additives) as presenting no real public health threat. It is well known that chronic effects may be observed as the result of repeated ingestion of a number of small doses, each in itself insufficient to cause an immediate acute reaction but in the long term having a cumulative of protracted action of low concentrations of chemicals upon human health. PM as well as many other materials are likely to be a depot of organic (sometimes inorganic) compounds which during the lifespan, are discharged into the environment, polluting various contact media such as food in measurable amounts and thereby become indirect food additives.

Basically antioxidants releases from polyethylene, and plasticizers from PVC. In studies cited in food additives and contaminants LD,HD and PP bottles releases measurable levels of BHT, Chimassorb 81, Irganox PS-800, Irganix-1076 and irganox -1010 into their contents of vegetable oil and ethanols.

It is known that food contact applications are numerous and include the use of plastics, cellulose, paper, Aluminium, foil, glass, rubber, printing inks, and coatings. PM in particular, are widely used in contact with foodstuffs, namely, in food processing equipments, food utensils, and as food packaging. Polymeric materials are manufactured by polymerization or by polycondensation of one or more monomers and / or other starting substance. As basic polymers, the following compounds are most widely used (21 CFR) in process :

Vinyl resinous substances (Polyvinyl acetate, Polyvinyl alcohol, Poly vinyl butyral, Polyvinyl chloride, Polyvinyl formal, Poly vinylidine chloride, Polyvinyl pyrrolidone, polyvinyl stearate, a number of polyvinyl chloride copolymers).

Styrene polymers (Poly styrene, Methyl styrene polymer, styrene copolymers with acrylonitrile and methyl styrene

Polyethylene and its copolymers
Polypropylene and its copolymers
Acrylics and their copolymers
Elastomers

Plastics Used in Packaging Materials/Abbreviations Used:

EVA: ethylene/ vinyacetate copolymer; HDPE: high-density polyethylene; PE: polyethylene; PET: polyethyleneterephthalate; PP: polypropylene p-PVC plasticized polyvinylchloride; and RCF: regenerated cellulose film.

In the manufacturing of polymeric materials, numerous additives are used depending on the type of produced polymers. These additives include plasticizers, antioxidants, catalysts, suspension, and emulsifying agents, stabilizers, and polymerization inhibitors,

pigments, fillers etc. These additives are bound either chemically or physically into the polymers and may be present in their original or an altered form. In addition, the polymerization process may leave trace quantities of residual monomers of low molecular mass polymers in the Polymers.

All additives are liable to break down during processing, some such as antioxidants, are intended to do so to fulfill their function. A number of PM release not only additives into the environment but also monomers that could be present in PM as residues or have appeared as a result of distructive processes. As a metter of fact PM appears to be a complicated and mobile system that is more or less stable , depending on its age, manufacture technology, and conditions of actual use.

Potential migrants encompass a large group of substances with differing molecular mass and physical properties. In some cases it is impossible to assess accurate amounts of ingredients migrating from PM into contact media. Migration levels can be considerably affected by destruction processes aging of plastics, and by the presence of unbound low molecular- mass compounds. The extent to which migration occurs will depend upon such factors as the contact area, the rate of substance from PM into food is also related to the type of food packaged in PM. Alcohalic beverages and edible fats and oils will extract substances more readily than dry food such as cereals.

The high molecular mass polymer itself does not pose a toxic hazard, being inert and extentially insoluble in food. Monomers are very reactive and biologically agressive. Some of them have been shown to cause allergic effects, to damage the liver and reproductive functions, and to induce carcinogenicity.

Plasticizers are used to assist processing and impart flexibility to plastics. They intersperse around the polymer molecules and prevent them from bonding to each other so tightly that they form a rigid substance. Plasticizers may lower the melting point of the plastic, and many have relatively low melting points themselves. Plasticizers can be present food packaging materials in significant amounts and have the potential to migrate into food. The migration of plasticizers can be aggravated by heat and by the presence of a food into which the plasticizing chemicals will dissolve.

As above said one of the maximum utilized plastics is polyethylene, polyphenylene. These are the mostly used for food grade application. PVC is the third one which is directly used for food packaging. Polythene and PVC is directly related to the health hazardous non bio degradable wastages.

Perhaps some of the plastics are so useful that they can not displaced by any other alternatives. Such as Poly sulphone is used for electro and cryogenics surgical tools. Acrylo nitrile butadiene styrene is basically used for surgical clips and portable malayria centrifuge. Poly methyle metha acrylates is used basically for opthelmic applications- Contact lenses. while Poly carbonate is used for tissue culture dishes, housing for blood cleaning systems and TPU is used for bone support stomach lining and artificial skin and heart. LDPE is utilizes in medical applications for flood transfusion system, gas transfusion tubes and blood transmission set. High density polyethylene is used for fine mesh for repairing of incisional herinias.

As the above said plastics polymers are utilising in to critical applications, their use is too

limited that they are not basically responsible for the environmental hazardous non bio degradable pollution.

Conclusively the polyethylene and PVC products are generating the new generation of wastage and creating the new limitations in the form of bio degdradable and non bio degdradable wastages.

Nature of polymeric Molecule

With the above picture it does not clears that other polymers don't have any toxic effect, they have but not in the form of polymer. It is only in the form of monomers. The polymers are not basically toxic by nature But the monomers of some of the plastics are toxic naturally But after polymerization every chain of polymer changes in to stable form by releasing other atoms according to the reaction. But during production of plastic product some processing aids like plasticisers, colourants, wax and other chemicals added to the polymers, this is only the process of mixing by thermal energy. There is no bonding takes place between polymeric material and processing aids.

In polyethylene pigments are used necessarily for colorful films. Bismuth Vanadate are now used in place of lead based pigments. Iron blue, Iron oxides phthalocyanin blue, green pigments and organic pigments are also used in polyethylene polymers.

These processing aids releases timely in end use applications and make the content toxic. Cobalt, Lead, Mercury, Cadmium, Chromium and their salts and complexes like stearates and phthalates are generally incorporated in the processing. Teratogenic and Carcinogenic properties have also been shown for these chemicals. Their persistence and bio accumulation at all levels in the food chain is also a distinct possibility. The effect comes due to the above plasticizers may be corrosive ulceration, madness and paralysis, muscular conversions, acute corrosive bronchitis, carcinogenic actions, chronic pulmonary and renal tubular disease. Skeletal and cardiovascular systems may also be affected. Chromium toxicity causes chronic ulceration and injury to nasal septum and cancerous too.

Phthalic anhydride is used in the synthesis of primary amines the agricultural fungicide phaltan and thaledomine. Phthalic anhydride is an important chemical intermediate in the plastics industry from which are derived numerous phthalates esters that function as plasticizers in used as a monomer for synthetic resin such as glyptal the alkyl resin and polyesters resin. Phthalates are used in PVC to make it soft and elastic as plasticizers. Plasticizers account for more than half the weight of some flexible PVC products. Since they are not clinically bond to the PVC polymer itself, Phthalates readily leach out of PVC products upto 1% of phthalates content of PVC products is released each year. Exposure to phthalic anhydride may occur during its use as a chemical intermediate. The acute effect from exposure to phthalic anhydride in humans consist of irritation. To eyes, respiratory tract, and skin but no permanent injury is observed. Chronic effect observed in workers phthalic anhydride included bronchitis and irritation of chronic exposure to styrenic in humans results in effect on the central nervous system, CSN disfunction. As a result of their continuous release during the production, use and disposal of PVC products, phthalates are often describes as the most abundant man made environment pollutants.

Although phthalates such as DEHP [di (2- ethylenexyl) phthalates] have been linked an animals studied to a varity of illness including, reproductive damage and damage to the kidneys and liver.

Bio Degradable Polymers

Some work has been done in the field of biodegradable polymers degraded only 2 - 3 % and thus these are not successfully controlling the formation of wastages. The degradable polymers are basically incorporated additive into the polymers. These may be Starch based polymers which are manufactured using starch based materials and need to be in an environment such as in a land fill or compost heap for the bags to degrade. There are three types of additives to use for biodegradable types plastics products

1. Polystarchadditives
2. OxoBiodegradable
3. UV degradable

Polystarch additives have been developed for the use in olifinic materials. For making degradable film Polystarch N is added up to required level. Oxo biodegradable is a non starch based additives. This additive is loaded and works as PDQ-H. The exception is that the end product will have a brownish tint. Photo degradable polymers are those which degrade in sunlight. The most useful polymers whose life can be controlled started to degrade when exposed to life heat stress and even inside cup. The additive which is best suitable in terms of costs is PDQ-H. It does not contain starch. Its degradation can be made fast or slow by adjusting the percentage of additives.

Conventional plastic materials such as polyethylene, polyolifins, poly vinyl chloride and other thermoplastics and thermosetting materials and other chemical structures such acrylics and epoxide have conventionally had additives introduced into their liquid state to provide sanitizing properties. For example certain plastics has rendered effective against gram positive micro organism where other additives have been utilized to effect gram negative organisms. Also it has been conventional to combine the gram negative and gram positive bacteriostates to produce a plastic materials wheather sheet, film or a molded article that will inhibit the growth of the gram positive and gram negative organisms.

It has been determined that certain alkyl phosphate derivatives can be dispersed into a liquid or molten phase to provide unique fungicidal and bactericidial properties to the plastic and sanitizing properties remain during molding of plastic materials. Alkylephosphate derivatives are generally suffeciently effective when less than one percent additive is used by weight of the weight of the plastics material.

The coming known examples of hazardousness produced by plastics define that only some of plastics are responsible for that - Mainly polyethylene and Polyvinyle chloride because both of these two are using for food grade applications at very large scale.

Plasticizers Used For

In the food packaging and food processing industries the plasticizers most often used are : BBP: Benzylbutylphthalate; DBP: Dibutylphthalate; DiBP: Diisobutylphthalate; DiDP: Diisodecylphthalate; DEHA: Di (2-ethylhexyl)adipate; DEHP: Di(2-ethylhexyl) phthalate; DPrP: Dipropylphthalate; DiPrP:

Diisopropylphthalate; and DiOP Diisooctylphthalate ATBC is commonly used in vinylidene chloride copolymers.

Flexible greenhouse films are made from low density polyethylene (LDPE), linear low density polyethylene (LLDPE), ethylene-vinyl acetate copolymers (EVA), and similar polymers. In their natural state these polymers deteriorate rapidly when exposed to sunlight. The suns ultra violet (UV) light transfers its energy to the polyethylene molecules causing them to become so energized as to break apart. Several successful stabilizer additives have been used by film manufacturers to arrest this natural degradation. Although effective these additives caused discoloration of the film and reduced light transmission. Free radicals are high energy particles released when UV energy “breaks” a polymer molecule. This develops a chain reaction with each radical potentially striking and breaking other molecules, releasing more and more radicals, until the film has degraded to the point of failure. The HALS additive effectively restricts the multiplication of these free radicals.

Certain chemicals attack the polymer itself. These are usually oil based solvents in paints and petroleum distillates used as solvents for wood preservatives. Avoid direct contact of any polyethylene film with oil base paint products or wood preservatives. Other products, such as copper bactericide sprays may catalyze the breakdown of polymers. High concentration of chlorine, commonly used in the greenhouse as a disinfectant, will also adversely affect the polymer. There are also chemicals in the greenhouse environment that affect the HALS stabilizers. Sulfur, halogens (fluorine, bromine, chlorine, etc.) and chemicals containing them, especially pesticides, are very aggressive in deactivating the HALS stabilizers. Using foggers and smoke generators also leads to direct contact of the pesticide with the plastic and can shorten polyethylene film life. Over spray can lead to large volumes of pesticide coming in direct contact with the plastic and should be reduced or avoided.

Plastics as such are harmless and environmental friendly. Among the various waste management options plastics recycling is more ecofriendly and energy saving. But this big field of plastics (Resins) is ecofriendly upto that extent until unless the misuses of these materials started. Plastic polymers are non-toxic by nature and improper waste management of various plastics makes them harmful. Today, there is no field where it is not applicable. So, it is necessary to highlighten plastics consumption pattern. Because waste management is not properly effective by which it cannot be environmental friendly in a true manner.

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