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ORIGIN, CHARACTERISTICS & TREATMENT METHODS OF SYNTHETIC DRUGS WASTE

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Abstract: Water consumption and wastewater discharge of pharmaceutical industries are quite large. The wastewater of pharmaceutical formulation as well as bulk drug industries contains many organic inorganic and synthetic drugs.
Natural drugs products which are derived mostly from macroscopic plants and occasionally animals. Synthetic drugs are manufactured in a factory using processes similar to that of organic chemicals. Most of the wastes are toxic to biological life and are usually characterized by high BOD, COD and T.S. wastes from these plants are either highly alkaline or highly acidic.
Keywords: organic, inorganic, synthetic drugs BOD, COD, T.S.

Introduction

Industrialization is necessary for the growth of any country. The pulse of the nation is felt by its industrial development. But with rapid industrialization and urbanization problems of environmental pollution also come into the picture. Industries pay less attention towards the treatment of effluents and spend very little money on neutralization of the effluents.

Natural products continue to play an important role in the discovery and development of new pharmaceuticals, as clinically useful drugs, as starting materials to produce synthetic drugs, or as lead com-pounds from which a totally synthetic drug is designed. At the same time, synthetic compounds, unrelated to natural products, have played an increasingly progressive role in new drug discovery. Continuous improvements in synthetic methodology have provided practical access to a vast array of synthetic substances, most recently in the form of combinatorial synthesis. Natural compounds and synthetic compounds are, in many respects, complementary as avenues for new drug substances since natural products often possess complex structural features not easily accessible by total synthesis. In this brief overview,

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some selected examples will be provided from the categories of natural, semi synthetic and synthetic drugs in relation to the central theme of this article.

Types of drugs

Natural drugs

The drug products which are derived mostly from macroscopic plants and occasionally animals e.g. Many alkaloids such as strychnine and brucine come into this category.

Synthetic drugs

These drugs are manufactured in a factory using processes similar to that of organic chemicals e. g. Acetyl salicylic (aspirin) and sulfa drugs come into this category.

Origin, Characteristics of Synthetic Drugs Waste

The synthetic drugs plants utilize large number of both organic and inorganic chemicals and usually produce a variety of drugs in different section of the plant. The volume and composition of the liquid waste not only vary from plant to plant, but also from section to section in a plant; producing different types of drugs from different raw materials and using variety of processes. Therefore a "typical" plant cannot be considered in the synthetic drug industry.

In general most of the wastes are toxic to biological life and are usually characterized by high BOD, COD and T.S. wastes from these plants are either highly alkaline or highly acidic. These wastes gave a negligible fraction of settelable solids in their total solids contents. Highly alkaline wastes originates from the manufacture of sulfa – drugs and vitamin B_1. Manufacture of certain organic intermediates gives rise to a highly acidic waste consisting of both organic and inorganic acids.

Pollution aspects of synthetic drugs

Wastes containing toxic substance like cyanides and heavy metals if discharged without any treatment are harmful to the aquatic life in the streams. These toxic elements interfere with the biological sewage treatment units very badly. Similar effects are observed with raw acidic wastes; these wastes corrode structure in the sewerage system. Due to their high BOD content, a raw waste when discharged into the streams and renders the water unsuitable for further use.

Treatment of synthetic drugs waste

Due to the great pollution potential and the diverse characteristics of the waste water from different section of the plant, the planning for the treatment of synthetic drug waste should be preceded by careful study of each waste.

Methods of treatment of such wastes are reported by Drydon et al, Vogler et al. and Mohan Rao et al. as segregatition of organic and inorganic waste, equalization & neutralization. segregatition and equalization very often improve the overall treatment efficiency and reduce the cost of treatment.

The acidic waste, waste containing toxic elements and those containing offensive odour producing compounds are usually segregated and are treated separately. In large Synthetic drug plant, producing a large number of synthetic drugs, different sections of the plant are found to discharge different types of waste. These wastes contain seventy chemicals including organic acids and large number of organic and inorganic toxic materials. After a careful study of the wastes from all the section, the acidic waste is segregated and treated separately whereas the wastes from the remaining section are treated biologically.

The treatment of acidic wastes consist of neutralization by lime to pH 7.0 and drying of neutralized waste over sand drying beds for 5 to 6 days for the separation of sludge. The neutralized filtrate still contains large amount of sulfanidic acids (about 75 of that in the raw waste)

Antibiotic Drugs

These drugs are manufactured by micro-organisms during their normal metabolic reactions e.g. Penicillin and Streptomycin.

Origin, Characteristics of Antibiotic Drugs

Antibiotics and vitamins are produced by the fermentation of fairly complex nutrient solutions of organic matter and inorganic salt by fungi or bacteria.

In the production Penicillin, molds of **"Penicillin notatumchysegenun group"** are cultured under submerged aerobic conditions on a medium consisting of corn steep liquor (nitrogen sources), peanut meal, mineral salts an lactos. After fermentation the mold mycelium is separated by filtration. The filtrate is then acidified to a suitable pH using phosphoric acid and the penicillin is removed by extraction with amyl acetate. The solution of penicillin is further extracted with a buffered solution of sodium chloride. The isolated penicillin is finally purified by extraction with an organic solvent.

Streptomycin is produced in asimilar using "Streptomycin griseus" culture on a medium consisting of glucose cornsteep liquor etc. The fermentation broth is filtered and the filtrate is absorbed on charcoal or resin. The Streptomycin is eluted from the charcoal or resin with dilute acids.

The elute is then neutralized and concentrated. The crude Streptomycin is then precipitated by the addition of acetone and further purified. Yields from the above processes in terms of weight are small, and out of the raw materials used in the fermentation, more than 90% appear as waste. This waste mycelium may either be sold as manure or stock feed, or may be disposed off in any other way.

The composition of the combined wastes from two typical plants producing penicillin and streptomycin has been studied by Murdi S.S. (1968).

Pollution aspects of Antibiotic drugs

If crude from an antibiotic waste is discarded in to a stream, it not only imparts an objectionable odour to the stream, but also adversely affects the biological population in the stream.

This waste should not be allowed to discharge into a municipal sewer, unless the sewage treatment plant is properly designed to handle a wildly varying and concentrated waste from such a plant. Penicillin waste is found to have a disturbing effect on the process occurring within the sludge digestion tank.

Treatment of antibiotic drugs waste

A large pharmaceutical complex in India producing antibiotics, vitamin C, symbiotic and fine chemicals, treats its liquid waste of high acidity in two stages (Rajagopalan et al, 1973);

1. In the first stage after equalization of the waste, the high acidity is neutralized with lime and then clarified.
2. In the second stage the conventional biological process is employed to reduce the BOD of the waste further.

Antibiotic wastes can neither be clarified in settling tanks, not can be chemically coagulated to reduce BOD (Koziorowski & Kucharski). The poor response of waste to the coagulation is due to the fact that most of the substances contributing to BOD appear in solution.

Conclusions

Although most of the drugs in use today are synthetic drugs, many (perhaps half or more) had their beginnings as natural products. Only a few have been cited here for illustrative purposes. Safety, effi-cacy, pharmacokinetics, metabolic or chemical stability, and other important characteristics of a drugare function of the chemical structure of the molecule, not its origin. The molecular structure of a com-pound, which defines its interactions with other molecules in the body, is the prime reason it exhibits desirable and/or undesirable biological

activities. Whether the compound is of natural or synthetic origin is irrelevant. To correlate origin with an expected greater or lesser safety profile or desirable features is unfounded, and can be dangerously misleading. Many of the most toxic chemical substances known are natural products, and some of the safest, most effective, and widely used drugs are of synthetic origin. In fact, structure–activity relationship (SAR) studies and synthetic modifications of bioac-tive natural products are usually done in an effort to produce an improved drug substance with a better therapeutic index. Thus, many of the most successful and important drug substances are derived througha combination of natural product chemistry and synthetic chemistry.

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