CERTIFICATE OF COLLABORATION

between
Department of Chemistry, Girraj Govt. College(A), Nizamabad
&
Department of Chemistry, TARA Govt. College, Sangareddy(A)

Department of Chemistry, Girraj Govt. College(A), Nizamabad and **Department of Chemistry, TARA Govt. College, Sangareddy(A)** agree on engaging in collaboration for rendering Research and Academic quality enhancement for the mutual progression of both the institutions. The subject to mutual consent, the area of cooperation will include the following aspects;

1. Participation in seminars, workshops and academic meetings.
2. Extension Lectures and Training.
3. Joint Research activities and publications.
4. Designing and development of teaching and learning modules.
5. Certificate programs and projects for skill development.
6. Quality enhancement initiatives.

TERMS OF IMPLEMENTATION:

1. Details of the implementation of any particular exchange resulting from this Collaboration shall be negotiated between the two organizations.
2. This Collaboration becomes effective on the day it is signed and remains valid for three years.
3. This Collaboration will be renewed after three years upon the consent of both organizations.
4. Any amendment or modification to the present text shall be submitted for review to the competent authorities, and shall not binding unless reduced to writing and signed by both the organizations.
5. This Collaboration does not bind either of the two parties legally or financially. Its aim is to promote relations that will mutually benefit each organization, this being the primary aim of academic collaboration.

In witness whereof, the organizations hereto have offered their signatures.

Head of Department,
Department of Chemistry
Girraj Govt. College(A), Nizamabd
Date: 1/4/21

Principal,
Girraj Govt. College(A), Nizamabd
Date: 1/4/2021

Head of Department,
Department of Chemistry
Tara Govt. College, Sangareddy(A)
Date: 01.04.21

Principal,
Tara Govt. College, Sangareddy(A)
Date: 01.04.21
PRINCIPAL
TARA GOVT. COLLEGE
(AUTONOMOUS)
SANGAREDDY-502 001

IMPACT OF PHARMACEUTICAL EFFLUENTS ON AGROECOSYSTEM

Dr.Abhijit Kantankar, Assistant Professor of Chemistry, Tara Government College, Sangareddy (A), Sangareddy.
Dr.M.Sunitha, Assistant Professor of Chemistry, Girraj Government College (A), Nizamabad.

Abstract:
Agro-Ecosystem severely affected by anthropogenic activities in past century. Industrialization showed prominent impact on Agro-Ecosystem due to emission of un-characterized effluents in to the agricultural catchment areas. Among them effluents from Pharmaceutical Industries predominantly changes the delicate Environmental balance of Agro-Ecosystem and human interface. Majority of constituents of Pharmaceutical effluents contain Physiologically Active Organic Molecules (PAOMs) which may contaminate Agro-products, as consumption of these food products leads to silent complications to human health and also reduces the soil fertility and crop output as well.

Introduction:
Agro-Ecosystems are spatially and functionally coherent units of agricultural activity that involve both living and nonliving elements and display particular interactions. Agro-Ecosystems use a multilayer approach to species groups, energy flows, and fertiliser use. Agro-Ecosystems are dynamic systems that constantly change for a variety of reasons. Agro-Ecosystems are mostly impacted by anthropogenic influences. Always a semi-natural system, Agro-Ecosystems are heavily reliant on human activity, either directly or indirectly. Agro-Ecosystems are significantly impacted by anthropogenic chemical invasion in the form of fertilizers/pesticides and industrial effluents, in addition to natural elements like monsoons and topographical considerations. Agro-Ecosystem changes have an impact on crop output as well as human health. The chemical composition of Agro-Ecosystem not only contributed by soil fertilizers but also by industrial effluents which drastically pollute soil and water in the neighboring areas of Agro-Ecosystem.

Plants require external nutrients to complete their life cycle. As autotrophic organisms, plants only need inorganic materials, with the exception of hydrogen, carbon, and oxygen. As a result, atmospheric carbon dioxide serves as a major source of sustenance for plants. However, plants can absorb Organic Effluents into various areas of the plant under specific circumstances or if high amounts of organic compounds are made available to them. Depending on the chemical makeup of the absorbed organic molecules, the plant may accumulate or assimilate them, or it may use the absorbed organic molecules as precursors to create secondary metabolites. This process is known as biosynthesis or biogenesis. The morphology and physiology of the body are affected in different ways by these ingested organic compounds.

Industrial effluents cause significant water and soil contamination, which has an impact on crop productivity and human health. Pharmaceutical effluents mainly consist of API, solvents, heavy metals and traces of PAOM's like drugs. Numerous studies show how industrial effluents affect Agro-Ecosystems. Pharmaceutical wastes have been a significant contributor to both reduces soil fertility and crop output as well as potential human health problems. It has been demonstrated that when PAOMs, similar to pharmaceuticals, are present in effluents that contaminate water and soil even in traces amounts, they have a major negative influence on human health. Research on the effects of pharmaceutical effluents has also revealed that plants react favourably to pharmaceuticals even when only trace amounts are absorbed.

When used for irrigation, recovered water from the pharmaceutical industry introduces PAOM pollutants to the Agro-Ecosystem. Throughout the irrigation period, these contaminants' concentrations change. Some substances remain in the soil for months after irrigation, accumulating and gradually increasing in concentration (Kinney et.al., 2006). Veterinary pharmaceuticals, which

are widely employed in livestock husbandry, are excreted by animals in locations where there are livestock farms, and these pharmaceutical contaminants eventually make their way to the soil through both solid and liquid manure (Koschorreck et.al.,2002). Aqua cultural systems, where the use of veterinary drug is ordinary and necessary, also contribute to the dispersion of pharmaceutical into soil (Kupka – Hansen et.al.,1992).

Because the pollutants are hardly detectable, their biological and environmental impacts have not been adequately documented (Boxall et.al.,2008). Even on long-term and intermittent exposures, bio-magnification by transfer to humans through the food chain is possible, but the extent of accumulation or transfer in the human body is mostly understood (Cleuvers, 2003).

In this context it is very essential to know the plants response in terms of physiological and morphological aspects to a particular drug effluent under different pH, photo and concentration gradient conditions. This is essential to redesign the approach of the pharmaceutical effluents management. n the plants sometimes the absorbed PAOM's can be assimilated and might be act as precursors for biosynthesis of various secondary metabolites or they degraded into simple molecules (Biodegradation). In addition to this, these compounds may also contaminate food products served by plants, as consumption of these food products leads to silent complications to human health. On the other side most of the PAOM's are very good ligands and they can combine with heavy metals to form complexes which are highly absorbed by plants hence it is also important to study the extent of absorption of heavy metal of the drugs by the plants, to design newer strategies of phyto-remediation of heavy metals and Nutrition of micronutrients in an effective manner.

The microbial equilibrium of the Agro-Ecosystem is severely harmed by the buildup of pharmaceutical effluents in soil. Antibiotic-containing pharmaceutical pollutants will decrease soil bacterial population, which will have a negative impact on the anaerobic decomposition of organic matter, the nitrification process, and sulphur assimilation. For instance, oxytetracycline, a broad-spectrum antibiotic, inhibits nitrification at concentrations of 12.5-75 mg L^{-1}, which results in a buildup of toxic ammonia and nitrite (Klaver et al., 1994). As a result, pharmaceutical effluents always have an impact on microbial ecology, even in minute amounts, which further demonstrates their influence on crop production and yield formation. The morphological and physiological factors that are important in plant growth may change as a result of the floral ecology being contaminated by new contaminants with pharmacological origins. Sometimes these pollutants will bring mutations in plants which will affect floral biodiversity.

ABBREVATIONS:

API	Active Pharmaceutical Ingredients
PAOMs	Physiologically Active Organic Molecules

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