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Short Communication

The Role of Cyclodextrin Nanoparticles in the Removal of Environmental Pollutants

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Introduction

Environmental pollution occurs as a result of the accumulation and spread of various pollutants (waste materials, chemicals, radioactive substances, etc.) in water, air, soil. It can be caused by industrial activities, agriculture, energy production, transport, domestic wastes and other human activities. These pollutants can be released directly into water resources, atmosphere or soil. Environmental pollution has been increasing rapidly in recent years and has become uncontrollable. By 2030, the Global Sustainable Development Goals (SDGs) of the United Nations stipulate that everyone should have affordable, equitable, and universal access to secure, clean water [1]. It is our duty to protect the environment in line with the principles of reduce-reuse-recycle.

Types of environmental pollution are generally classified according to the types of pollution that affect different environments in the environment. The main types of environmental pollution are as follows: Air, Water and Soil Pollution. Water pollution constitutes an important problem among environmental pollution. As a result of human activities, organic pollutants such as dyes, pesticides, heavy metals cause pollution in wetlands.

Cyclodextrins (CDs) are cyclic oligosaccharides consisting of α-1,4-linked glycopyranose units. CDs are natural polymers and are produced by degradation of starch (mostly corn) with the enzyme glucosyltransferase. As they are biocompatible, natural polymers, they have a wide range of applications. Apart from pharmaceutical use, they are also used in agriculture, food, textile and cosmetics industries. It was first discovered by Antoine Villiers in 1891 and in 1953, Freudenberg., *et al*. obtained the first patent for the use of CDs in drug formulations. The nomenclature of CDs depends on the amount of glycopyranose subunit. The most commonly used are α, β, γCDs consisting of 6, 7 and 8 glucopyranose subunits, respectively [2].

Polymer-based nanoparticles are prominent due to their biodegradable and biocompatible properties. They also provide controlled drug release and pharmacokinetic control with chemical surface modifications [3,4]. They can be in natural and synthetic structure. They have a conical structure. Their inner cavities have a hydrophobic structure. The opposite structure prevails on the outer surface. Due to the steric hindrance, CDs require at least six glucopyranose units to be linked by α-1,4 bonds [5]. CDs with seven glucopyranoses are called β-CDs and those with eight glucopyranoses are called γCDs; CDs containing a large number of glucopyranoses are not preferred due to their low complex formation and increased solubility in water. It has been reported that CDs function as a transporter that provides membrane passage by keeping lipophilic active substances in aqueous solution and due to the low affinity of the lipophilic cell membrane to hydrophilic CDs, CDs remain in the aqueous outer membrane and increase the uptake of sufficiently lipophilic active substances into the cell [6].

Conclusion

In conclusion that, recently CDs polymers have received more attention for environmental pollutants such as heavy metals, dyes, pesticides, pharmaceutical contaminants, organic contaminants, and others removal because of their rapid adsorption kinetics, easy regeneration, and high mechanical stability.

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