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USE OF SUPERABSORBENT IN AGRICULTURE

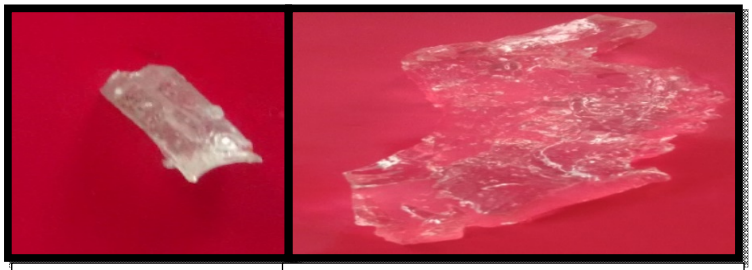
Priyal Pandey

Research scholar, Department of Soil Science and Agriculture Chemistry

Institute of Agricultural Sciences, Banaras Hindu University

Email of corresponding author -piu.pandey89@gmail.com

Introduction: Superabsorbent is cross-linked polymers with a hydrophilic group which have the capacity to absorb large quantities of water. Water absorption capacity arises from the hydrophilic functional groups attached to the polymer backbone. Inadequate use of rain & irrigation water by crops is most crucial problem in agriculture. Application of water-saving super absorbent polymers in to the soil could be an effective way to increase both water and nutrient use efficiency in crops. Superabsorbent addition in soil improved water retention capacity of soil and delays permanent wilting percentage under intense evaporation. Superabsorbent material can help agriculture by improving water use efficiency, increasing nutrient retention time for fertilizers, delaying wilting point in plant under water stress and remediation of waste water.



Dry	Superabsorbent after absorbing

These polymers are capable of large amounts of water from rain or irrigation water (up to 200-500 ml of water per gram dry weight of polymer) store it and prevent percolation losses.

Types of superabsorbent

i. Synthetic superabsorbent

Synthetic superabsorbent are made up of petrochemicals and are mainly composed of acrylic acid its salt and acrylamide. They are hydrophilic molecules and capable of retaining large amount of water. They are cost effective but their use arises many environmental concern due to their poor degradability, less knowledge about their fate in soil and water.

ii. Polysaccharide-based superabsorbent

In this context increasing attention on environmental issues, biodegradable superabsorbent catches interest for potential commercial application in agriculture. Superabsorbent prepared with natural material, such as cellulose, starch, guar gum, rice husk and chitosan, have attracted great attention because of their abundant resources, low production-cost and biodegradability. Polysaccharide-based superabsorbents are synthesized by (a) graft copolymerization of suitable vinyl monomer(s) on polysaccharide in the presence of a cross-linker, and (b) direct cross-linking of polysaccharide. Graft polymerization improves mechanical strength of superabsorbent.

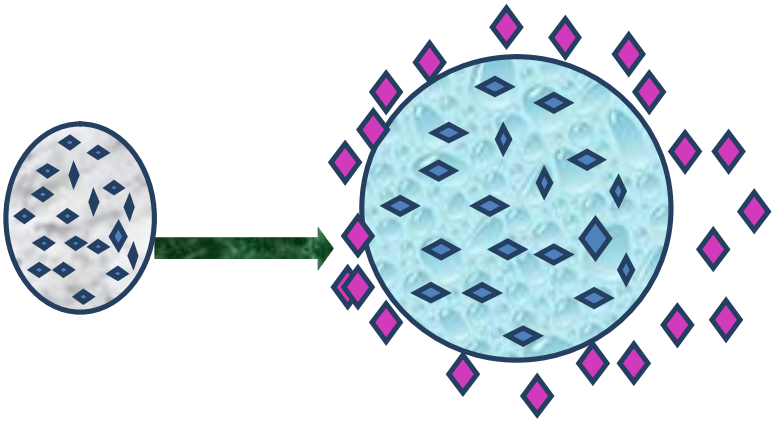
Importance of superabsorbent in agriculture Water retaining characteristics of superabsorbent increases the possibilities of its application in the agricultural field in

multifocal ways and has increasingly been investigated to alleviate certain agricultural problems.

Soil amendment

Superabsorbent have been successfully used as soil amendments in the agriculture to improve the physical properties of soil in view of increasing their water-holding capacity and/or nutrient retention of sandy soils to be comparable to silty clay or loam. Hydrogels potentially influence soil permeability, density, structure, texture, evaporation, and infiltration rates of water through the soils. Particularly, the hydrogels reduce irrigation frequency and compaction tendency, stop erosion and water runoff, and increase the soil aeration and microbial activity. In arid areas, the use of superabsorbent in the sandy soil (macroporous medium), to increase its water-holding capacity seems to be one of the most significant means to improve the quality of plants. The superabsorbent particles may be taken as "miniature water reservoirs" in soil. Water will be removed from these reservoirs upon the root demand through osmotic pressure difference.

Controlled released fertilizer



The hydrogels also act as a controlled release system for some nutrient elements, holding them tightly, and delaying their dissolution. It help in avoiding leaching, volatilization loss and toxicity of fertilizer. Urea, Phosphorous, micronutrient can be loaded in superabsorbent. It act as slow release system, nutrient are attached to superabsorbent particle either electrostatically or chemically attached to it. Two main processes govern the release of nutrients from the superabsorbent matrix, water penetrates through the pores into the dry mixture, forming a distinct and sharp wetting front. The process starts with a 'burst' of water into the matrix; fertilizers leave the matrix through pores either by diffusion alone or by diffusive and convective flows (Wu *et al*., 2008)

Seed coating

Superabsorbent can be used in the form of seed additives to aid in germination and seedling establishment. Superabsorbent polymer which can absorb huge water, after absorbing, it turn to water gel. This gel that can release water to plant when they need. As we know, there are three conditions needed for seeds to germinate: light, temperature, water and seed coating technology can improve two of them — **water** and **temperature.** It also provides some advantages such as **nutrients, protection against**

http://www.socochem.com/seed-coating-polymer.html

fungal diseases, or insecticidal treatments.

Carrier for pesticides

Synthetic chemical pesticides and herbicides (e.g. carbamates and organophosphates) are widely used to combat crop loss. Their toxic residues have caused great harm to humans and the environment. Polymer encapsulated formulations are superior to non-encapsulated commercial formulations in extending activity as well as redu cing evaporative and degradation losses , leaching. Agrochemicals are used to improve the production of crops. Conventional formulations of agrochemicals can contaminate the environment, in particular in the case of intensive cropping. Hence, there is a need for controlled release formulations of pesticide to reduce pollution and health hazards. Slow release formulations increase the water-holding capacity of soil, better control weeds in the long run.

Remediation of waste water

Adsorption is known to be one of the best of the technologies for the decontamination of water because it is an effective, economical and ecofriendly treatment technique. Adsorption is basically a mass transfer process by which the metal ion is transferred from the solution to the surface of sorbent, and becomes bound by physical and/or chemical interactions. All adsorption bonding physical adsorption can only be occurred in the environment of low temperature and under appropriate pH conditions. The need for strong adsorbents has been emerged due to the intensification of industrial activity and environmental stress. Superabsorbent proves to be a promising solution for remediation of waste water. It contain a variety of functional reactive group which are capable of absorbing heavy metals, anionic and cationic dyes from waste water.

Conclusion

Superabsorbent polymers because of their excellent properties were already well established in various applications such as disposable diapers, hygienic napkins, cement, drug delivery systems and sensors. In agriculture its water absorbency and water retention properties are of key importance. Their use for agricultural applications has shown encouraging results. They have been observed to h reduce irrigation water consumption, death rate of plants, improve fertilizer retention in the soil, increase plant growth rate and controlled release of agrochemicals.

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