AAB-e-hayaat zarkhez

AAB-E-HAYAAT ZARKHEZ is a super absorbent polymer which can absorb water up to 1000 times of its own weight. When mixed in soil, it slowly releases water and macro nutrients that are required by the crop hence, cuts the requirement of fertilizer by 50% and that of water by 70%. It will become a part of soil, make it fertile, and undergo biodegradation without formation of toxic species.

Submission #: 483

**Idea Origin**

Pakistan is an agricultural economy. The fertile plains of the Indus defined the lifestyle of the people in the region millennia ago. However, the droughts in the desert regions of Pakistan claim thousands of lives lost due to hunger.

In 2009-2010 this drought developed over the upper part of Pakistan that is Punjab, Khyber, Gilgit, Kashmir and Northern Baluchistan. Apart from regional discrimination, Rabi crops all over Pakistan are facing 4-5% annual decrease due to water scarcity.

Much of the summer rains are not available for crop production for longer periods due to a rapid run-off because of torrential showers. At other occasions, rain may be so light that the precipitation evaporates before the water can penetrate into the root zone. Rainwater alone is insufficient for agricultural requirements. On the other hand, The Himalayan glacier, whose ice melt replenishes the Indus River’s annual freshwater, is receding by about one meter - the approximate equivalent of 3.3 feet - per year due to global warming.

The idea of developing a Aab-E-Hayaat was conceptualized by two students of grade 11, Hassan Sohail and Hasham Tanveer. They realized that super-absorbent polymers are an easy solution to this problem. However, they had to tackle the disadvantages of the super-absorbent polymers available in the market today. The two spent months understanding and learning about the technology from Shayan Sohail, a chemical engineer from University of Engineering and Technology Lahore, who acted as the guide and instructor for the two.

The two lived in different cities and collaborated the development of Aab-E-Hayaat virtually. They spent months understanding and learning about the technology from Shayan Sohail, a chemical engineer from University of Engineering and Technology Lahore, who acted as the guide and instructor for the two. During this time, Sarib Zaman, a classmate of Hassan’s showed interest in the project and decided to become an active part of it.

**Our Solution**

AAB-E-HAYAAT ZARKHEZ is a potassium polyacrylate based super absorbent which can retain water up to 1000 times of its own weight up to a year and releases it slowly according to the need of the soil/crop along with all the essential nutrients required by the crop. It can be used in vast agricultural lands, large to small scale plantation, as well as household vegetation and plantation.

Once mixed with the agricultural soil up to 10%, it can be used over 4-6 yearly cycles until it biodegrades and becomes a part of soil without forming any toxic species. The characteristics AAB-E-HAYAAT ZARKHEZ possesses are as follows:

* High absorption capacity in saline and hard water conditions
* Optimized absorbency under load (AUL)
* Lowest soluble content and residual monomer
* Low price
* High durability and stability in the swelling environment and during storage
* Gradual biodegradability without formation of toxic species
* pH‐neutrality after swelling in water
* Photo-stability
* Re‐wetting capability

AAB-E-HAYAAT ZARKHEZ is the solution for all the problems related to water crisis in agriculture. Following are the few detailed advantages of using AAB-E-HAYAAT ZARKHEZ:

* Improves soil quality, preserves water and resists drought stress
* Increases seed sprouting and seedling development leading to better farm success
* From the environmental aspects, it is non-polluting and biodegradable, helps in reducing irrigation frequency and water consumption and creates a simple cyclic process to provide water directly to roots and prevent soil compaction
* In agriculture and agroforestry, it acts as micro water reservoirs at plant roots. They absorb natural and supplied water 600-1000 times their own weight and release it slowly on account of root capillary suction mechanism thus preventing water loss in soil by leaching and evaporation
* It can store the excess water that cause flooding in summers and utilize it in winter for compensating Rabi crop water shortfall
* It can keep the soil moisture up to desired level with continuous release of nutrients and hence, it can reduce the barren land
* Form a consistent cyclic process of absorption and release of water; the water so released can provide optimum moisture for quick germination and seedling maturation. Thus, it reduces seedling mortality by several folds in nurseries
* In cold regions, death during germination and maturation is common due to moisture freezing in & around plant root tissue. Absorbed moisture in hydrogels does not freeze and makes easy accessibility to plants. It also regulates seedling growth temperature preventing death by freezing
* It can help save water and labor by reducing irrigation frequency, help overcome drought conditions and act as soil conditioners, prevent leaching in sandy soils, runoffs in mountainous and sloping fields, improve virescence efficiency and restore soil biota
* It can reduce overuse of fertilizers and pesticides in fields. The chemicals so absorbed with water are slowly released thus extending the operational life and uptake efficacy by root systems
* It acts as soil matter flocculant. It closely binds loose soil thus forming loams that can help better root latching. Simultaneously, the repeated absorb-release mechanism prevents over compaction of soil minerals and provides space for aeration and development of soil edaphon.
* Low rates of soil application – 1-2 kg/ha for nursery horticultural crops; 2.5-5 kg/ ha for field crops
* It has a wide area of application ranging from agriculture, forestry, industrial planting, municipal gardening, drought management, water conservation, it helps reduce soil erosion by surface run-offs, fertilizer and pesticide leaching to groundwater, reducing the cost of water and irrigation and success rate at growth and high yields of crops.

**Current State**

We have currently developed our testing samples based on solution/suspension polymerization. However, we want to develop a further refined and purified product by using other methods such as:

* Emulsion Polymerization
* UV cured polymerization

The products developed by all these methods have slightly different characteristics such as swelling index and cross-linkage. Moreover, UV cured method is highly desirable as the product prepared by it is in hard granular form and requires no purification step other than drying on a conveyor belt whereas, in solution polymerization and emulsion polymerization, purification steps are required. Currently, we are in search of a capable partner in R&D who can provide resources (financial and equipment) for our lab scale development of AAB-E-HAYAAT ZARKHEZ production process capable of producing it at cheapest possible prices and with minimum material and simplest technology.

We are looking forward to developing lab scale process of all three methods in order to analyze the cost, ease of operation, and categories of superabsorbents produced by these processes.

**Future prospects of the technology**

AAB-E-HAYAAT ZARKHEZ has many other uses apart from agricultural one. It can replace RO based water purification. Our Sodium Polyacrylate based product is capable of absorbing 99.95% pure water up to 600 times of its own weight I-e if sea water containing TDS amount of 70,000 mg/L is available to it, it will absorb a water having TDS 35 mg/L. It is capable of releasing the water rapidly under UV light (Sunlight). This makes it a better option than RO in following sectors:

* It can be used in places where electricity is not available or where electricity is expensive
* It can become a part of emergency kits of NAVY and other public/ private ships
* It can also replace RO at industrial scale by development of AAB-E-HAYAAT based absorption bed columns

**Limitations**

* The amount of water absorbed can be reduced up to 30% depending upon TDS in water. (However, rain and river water have low level of TDS and no such significant effect is expected)
* The amount of nutrient release depending upon soil can significantly change the cost of the product
* The product performs better when it is dumped in the soil after absorbing water. Variation in water absorption capacity can be expected with different applying methods