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Application of Zeolite in Agriculture

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Zeolites are three-dimensional crystalline compounds that are built from AlO_4 and SiO_4 tetrahedra. The tetrahedral structures of zeolites can be further linked into different rings. Such structures are called secondary building units. They can contain more than 16 atoms in the ring (only the atoms located in the center of the tetrahedron (Si and Al) are considered). By interconnecting eight of the six members, a polyoctahedron (known as a beta-cage) can be formed. The selectivity on the surface of zeolite as an adsorbent depends on the $\text{SiO}_2/\text{Al}_2\text{O}_3$ ratio. Aluminum-rich zeolites adsorb polar molecules in their structure and are therefore used as desiccants. A higher proportion of silicon in the structure increases the hydrophobic character of the zeolite. The transition from hydrophilic to hydrophobic form is in the ratio $\text{SiO}_2 / \text{Al}_2\text{O}_3$ of about 20. The skeleton of zeolites is built from $[\text{SiO}_4]$ and $[\text{AlO}_4]$ tetrahedra, they are connected to each other, occupying one or more corners forming a ring through the oxygen atoms. The specific and unique structure of zeolites allows them to have a variety of applications. This is a new application of zeolite in growing a plant whose properties are improved thanks to the water that zeolites have in their structure. Soils that are mixed with zeolite for growing plants have a higher yield and retain their moisture for a longer time.

Our research was performed on plants that were tested on soil without zeolite and soil with added zeolite. The plant grown with added zeolite has better characteristics and a better yield.

Zeolite should be added to the soil every five years, and the yield of plants increases up to 50% and their resistance to various diseases. The root system with added zeolite becomes more powerful, seed germination increases. In our tests, it was shown that plants with zeolite require less watering than plants without zeolite. The result of that is the structure of the zeolite that retains water in its cavities and channels.

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