Solution

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Adsorption is a process by which specific components of a fluid mixture are bonded to the surface of a solid material, an adsorbent, to be removed. Of the many different types of adsorbents, activated carbon is one that has been shown to have great potential in removing pesticides from water.

Activated carbon has many advantages over its competition; one of which is its low initial cost, which comes from its simple design. Another important advantage of activated carbon is its high adsorption capability. This comes from its large surface area, which exists because of its many pores. These pores are actually able to be structured in a controlled way to achieve the desired results. For example, if a pesticide is being removed from a water source that contains large natural organic matter, pore sizes can be structured to prevent the organic matter from blocking the pores, which would impede the adsorption of the smaller pesticide contaminants. Specified pore structure comes with another benefit: high regenerability.

Some adsorbents, especially activated carbon, are able to be regenerated to be used again. This process involves the desorption of the pesticide contaminants, which can then be completely disposed of. Regeneration has its difficulties, but is an important step in reducing the cost of the overall pesticide removal process.

Activated carbon can take many forms which can be selected based on the type of pesticide desired to be removed. These forms can be prepared from date stone, used tires, and rayon, to name a few. The chemistry of the structure of the different forms of activated carbon has been thoroughly studied. It is thermally stable, has low reactivity to acids and bases, and has low sensitivity to toxic substances, all of which are important for versatility.

The structure of activated carbon is characterized by layers of pores, which are usually between 2 and 50 nanometers in diameter. These layers have space between them, further increasing the adsorptive surface area. The pores are great at attracting atoms, such as hydrogen, oxygen, sulfur, phosphorus, and nitrogen. The attraction of these molecules can be adjusted by altering the electrical potential of the activated carbon. This can allow for accelerated adsorption as well as desorption by reversing the potential; this creates a possibility for in situ regeneration of the activated carbon.

The high versatility, low cost, and regenerative capabilities of activated carbon make it an excellent option for removing pesticides of all kinds from contaminated waters. Further research should be conducted to maximize the output of the regeneration process, which would further lower the cost of using activated carbon for adsorption of pesticide-contaminated water.

References

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