BIOCIDAL PROPERTIES OF BETULIN AND ITS APPLICATION IN FILTERS FOR WATER TREATMENT

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Abstract

There are many filters with a carbon sorbents for drinking water used a silver as biocidal component. The silver is toxic and have high cost, and the sorbent containing silver after its lifespan is thrown out, and thus, this silver becomes irretrievably lost. Therefore, it is of practical interest to replace silver filters with inexpensive biocidal products. It is known that plant steroid betulin is suppressing the reproduction of microorganisms. The aim of this research is to shown that graphene sorbents coated with silver and betulin reduces the reproduction of colonies to almost the same extent.

Graphene sorbent is a light powder which was obtained by the method of destruction of interlayer graphite carbon bonds with strong organic oxidants, followed by heating to a high temperature. To prepare the sorbent on a carbon carrier (active carbon, expanded graphite), it is used a solution of betulin in an organic solvent (alcohols) or as a suspension which containing betulin in an amount of 1 to 5%. Following method is used to determine the number of viable microorganisms. A certain amount of betulin (0.1 g per 20 mL of medium, 0.5% concentration) and a mixture of betulin with graphene sorbent (in 0.1 g of betulin and 1 g of sorbent), respectively, were introduced into the melted and cooled to 40 ^{0}C nutrient agar for 20 mL of medium.

When studying the influence of birch bark extract on *Pseudomonas aeruginosa, Streptococcus aureus, Escherichia coli* and *Bacillus cerus,* it was shown that betulin has an antimicrobial and antifungal action. This effect is enhanced by the application of betulin to the surface of carbon sorbents (activated carbon or graphene). Comparison of biocidal properties of betulin on a sorbent in comparison with a similar amount of silver on a sorbent showed reduced reproduction of microorganisms (colonies) to almost the same extent.

The influence of the plant steroid betulin on reproduction suppression of *E. coli* and other microorganisms on the surface of carbon sorbents is shown to suppress their growth 5 - 7 times more, compared with the use of components separately. The use of betulin to inhibit the multiplication of microorganisms used in the filters gives a similar biocidal effect compared to the coating of the carbon sorbent with silver. Based on carbon sorbents (active coal and/or foamed graphite) using the plant biocidal product betulin, a composition that has been obtained which can be recommended as a filler of the filters instead of silver in the manufacture of filters for purifying drinking water. Betulin differs in that it does not interact with the oxygen of the air dissolved in water, is not sensitive to sunlight, is not toxic, is cheaper than silver.

***Key words**: Graphene, Betulin, Clearing water, Filters.*