

CONCERNING POSSIBILITY OF USING SORBENTS FOR PRODUCTION OF ENERGY PLANTS AND HYDROGEN ON THEIR BASIS

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Introduction

Fuel and energy crisis in 70-s' and its reoccurrence in the beginning of XXI led to a sudden rise in the price of petroleum. This crisis stimulated the researchers all over the world to look for the new alternative sources of energy. Following the concept of prof. Karl Hainz Tetplaff /1/, the new sources of energy are going to change technologies, transport appearance and become an impulse for the development of emerging countries. The cause of these revolutionary changes can be the so called "green energy" production, or production of energy plants.

Today western countries are oriented on selection of the most productive, in sense of year-on-year biomass increase, plants /2,3/. In this work we consider it necessary to draw attention to quite effective way of treatment of contaminated water and soil with simultaneous biomass increase. The method is based on phytosorption that was discovered in 1996 by us /4/.

Results and discussions

During the study of the possible accelerative factors on the process of soil treatment, it was shown /4-6/ that composite sorbents (mixture of carbonic and mineral sorbents), when introduced around the root area leads to intensification of radionuclide accumulation by plant and the increased growth of plant (in 2-3 times) in comparison to the control plants. The experiments with radionuclide accumulating plants in combination with composite sorbents gave us unexpected 6-8 times acceleration of radionuclide extraction from soil in comparison with known methods. The only weak point of phytosorption is the necessity of following utilization of radionuclides by means of combustion. Global changes since the Chernobyl catastrophe, including the energy crisis, made us look at the obtained results from a new angle. We considered the possibility of using phytosorptional effect to produce energy plants i.e. to increase the rate of green biomass accumulation.

As was shown previously /4-6/, the nature of sorbent introduced around the root area has an influence upon the biomass increase process. More detailed research (figure, table) proves that the most significant biomass increase is observed when using composite sorbents - mixture of natural and mineral sorbents.

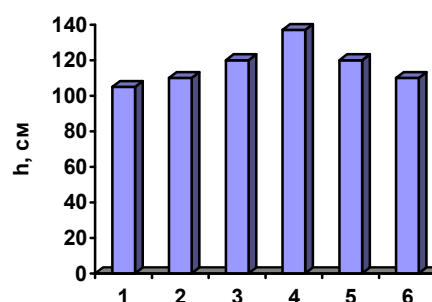


Fig. The influence of the sorbent nature on the growth of amaranths: 1 –no sorbent used; 2 – mineral sorbent; 3 – carbonic sorbent; 4 – carbonic + mineral sorbent; 5 – modified mineral sorbent; 6 – TiSi.

The cumulative (synergetic) effect of using composite sorbents has been known for a long time, thought it was mainly observed in sorptive processes. In our case the mixture of sorbents plays the role of initialization intermediate for the process and the biomass increase is implicated.

Taking into account the great social and economic importance of the discovered effect, which gives an opportunity to see new prospects of energy plants, we have investigated possibilities of cultivation of energy plants on contaminated soils. It was found that depending on the sorbent nature, when introduced around the root area, we can regulate the biomass growth. The most significant effect of biomass increase is observed in case of using mixture of mineral and carbonic components. It is also important that the number of inflorescences increases in 2-3 times. It gives us opportunity to get, besides biomass increase, synthetic fuel from the seeds.

Table. The parameters of pedicel and root of mustard: 1 – no sorbent used; 2 - natural biosorbent; 3 –carbonic sorbent; 4 –mineral sorbent; 5 – natural biosorbent +mineral sorbent; 6 – carbonic + mineral sorbent.

№	The length of above-ground part (cm)	The length of the root (cm)	The diameter of the stem 10 cm above the root (cm)	The diameter of the stem 40 cm above the root (cm)	The diameter of the stem at the topmost point (cm)	The number of inflorescences (items)	The mass of the plant (g)
1	69,5	6,5	0,4	0,35	0,15	4	8,2
2	80,5	13	0,6	0,5	0,2	7	22
3	83,5	14	0,75	0,5	0,2	10	44,2
4	77	11,5	0,6	0,4	0,2	15	24,6
5	80	13	0,75	0,45	0,2	10	47,4
6	85	13	0,8	0,6	0,25	8	42,4

Conclusions

The analysis of obtained data gives following conclusions.

The effect of not only sorptive but stimulating role of sorbents is discovered. The sorbents introduced around the root area increase the growth of plants greatly. It was found that the accelerated growth of plants that was induced by sorbents stimulates the 5-6-fold biomass increase, which is of great interest for the hydrogen production.

The most obvious parameter of plant that is influenced by the presence of sorbents is the number of inflorescences in 2-3 times.

References

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