INVESTIGATION OF SOIL FERTILITY AFFECTED BY BIODIESEL BY-PRODUCT IN MICROCOSM EXPERIMENT

SZENT ISTVÁN EGYETEM
MEZŐGAZDASÁG- ÉS KÖRNYEZET-TUDOMÁNYI KAR, GÖDÖLLŐ

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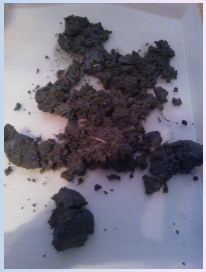
Abstract: On the grounds of expedience, versatile investigation of industrial by-products has to be considered to protect the environment. This consideration has been revealed the field of biodiesel production. Glycerol, which is a by-product from biodiesel production is available in such a large amount, that it can not be disposed in the traditional utilization ways. This glycerol is contaminated and the cleaning process is rather expensive. The pollutants originated from oil seed proteins, containing carbohydrates, as useful plant nutrients, and also potassium hydroxide is used as catalyser and methanol used for transesterification, which ingredient can be utilisable. There is a noticeable tendency, where manufacturers try to recover methanol during the process in order to reach a higher technological efficiency. Potassium content of potassium hydroxide is a plant nutrient. In addition alkalinity can be important in compensation of soil acidity.
According to our previous investigations on hygroscopic ability of crude glycerol influences the germination of plant seeds. As an easily degradable organic matter stimulates microbial activity in the soil and alters the C/N ratio, which can cause a temporary nitrogen deficiency. The nutrient supplying capacity of soil influenced by glycerol was examined in microcosm experiment. Approximate observation is capable to monitor the complex ecological effect for a small scaled soil-plant-animal system. The soils were treated by glycerol and potassium nitrate. ***Lolium perenne*** as indicator plant and ***eisenia fetida*** as indicator animal were applied for this investigation.

Materials and methods

The microcosm experiments were set in 1000 cm^3 wide-mouthed glass jars and filled with 500 g of soil. As test plants ryegrass (***Lolium perenne***), as the test animals manure worms (***Eisenia fetida***) were used for the experiment. A sandy soil from Fót was applied for treatments. The main properties of this soil: K_A=28.33, $CaCO_3$%=8%, pH_{H2O}=8.2, H%=1.4%, AL-P_2O_5=95 ppm, AL-K_2O=120 ppm. The solution were: 1000 mg.N.dm^{-1} KNO_3 and glycerol 5% C content.

Treatment	Code	N ppm	N-sol. cm^3	C %	G-sol. cm^3	DV cm^3
Control	C	0	0	0	0	100
Glycerol	G	0	0	0,5	40	60
N (nitrogen)	N	100	40	0	0	60
N + Glycerol	NG	100	40	0,5	40	20



Treatments were replicated in three times and were adjusted to 5-5 worms. 14 days after water saturation of the soil in the attempted expulsion of worms in order to change their mass determined.

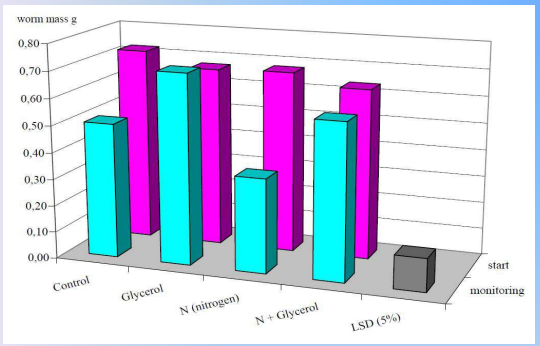
Results and discussion

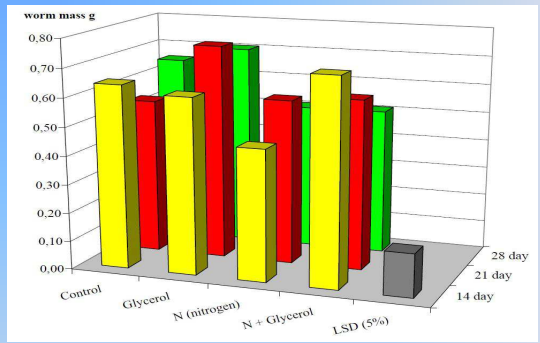
The change of worms weight was evaluated by three factor variance analysis. Factors:

„A" the three sampling day (day 14, day 21, day 28)
„B" treatments (Control, Glycerol, Nitrogen, Nitrogen+glycerol)
„C" the starting date and the observation time points measured masses

The effect of the factor „A" (elapsed time to the sampling) to the other factors calculated average weight did not change significantly (F-rate=0.15).
The effects of the factor „B" (treatments) are evaluated on the other factors calculated average on the worms average mass (g).

Treatment	Control	Glycerol	N (nitrogen)	N + Glycerol	LSD (5%)
"A" mean	0,61	0,69	0,52	0,60	0,08





It is apparent the Nitrogen + Glycerol treatment did not show significant change compared to the control sample. The Glycerol treatment significantly increased the weight of the earthworms, while the nitrogen only treatment considerably decreased that. It shows similar picture to the „AxB" interaction analysis.

The prime equal average worm's weights are significantly changed due to the treatments. In the case of control and nitrogen only treatment the average of the worms mass are reduced significantly. The average weights of worms are also reduced in the nitrogen only treatment compared with the control sample. Examining the average weight of the worms at different test dates, it is apparent that the nitrogen treatment causes worm mass reductive effect.

Conclusions

We studied changes in soil fertility with nitrogen and glycerol treatment in complex systems which are includes plants and animals also. Both plant and animal weight changes suggest that the industry by-product as glycerol resulting positive impact on the fertility of soils.

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