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CHARACTERIZATION OF PELLET SAMPLES OBTAINED BY PELETIZATION OF LIMESTONE AND SEAWEAD

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Abstract

This paper presents the results of physico-chemical characterization of both the initial samples of lithotamnian limestone and seaweed (Ascophyllum Nodosum), and the products of aggregation of their mixtures in different ratios by the pelletization process. The initial samples were waste limestone from filter plants and dried seaweed. The final product of the pelletization process should serve the needs of agriculture as a means of biostimulation and can also be used in raising the pH levels of acidic soils. Several different pellet formulations were obtained by the process of discontinuous pelletization, and also by using a simulation of the continuous pelletization process on a pelletization plate. Tests of the mechanical properties of the pellets showed that the best results are shown by the pellets of the 4K sample, which were obtained by a continuous pelletization process with a mutual ratio of seaweed and limestone of 70:30%.

INTRODUCTION

One of the most important parameters of soil fertility is substitution acidity. Over 60% of arable land worldwide can be classified as acidic. This is a consequence of the geological substrate and other natural factors, but also of industrial development and irresponsible attitude towards the environment[1]. In Serbia, 13% of the soil is extremely acidic (pH ‹4), 17% very acidic (pH = 4-4.5), 30% medium (pH = 4.5-5.5), and 22% slightly acidic (pH = 5.5-6.5), while only 18% with a neutral and alkaline reaction [2].

EXPERIMENTAL

Homogenization of limestone and the required proportion of seaweed was performed, with the addition of water, after which the entire sample was homogenized and added to the pelletizing plate, on which the required minimum amount of additional water was added. The inclination of the plate (60°) and the number of revolutions (50 min^{-1}) were constant, while the amount of binder was changed. The formed "green" pellets were stored for 24 h at room temperature. In the process of simulation of the continuous pelletization, the homogenization of limestone and the required proportion of seaweed was performed without the addition of water, after which the homogenized sample was continuously added to the pelletizing plate with a vibrating feeder, to which the required amount of water was added. All other pelletization conditions were identical to the discontinuous pelletization process. This way, the following samples were obtained (according to the % ratio of seawead and limestone):

• Sample 1L: 50: 50%;• Sample 2K: 50: 50%;• Sample 3L: 70: 30%;• Sample 4K: 70: 30%

RESULT AND DISCUSION

OTable 3 shows the summary results of testing the mechanical properties of limestone and seaweed pellets, obtained by the discontinuous process and the simulated continuous pelletization process.

Table 3. Aggregate test results of "green" pellets;

RESULTS AND DISCUSSION

Table 3. shows the summary results of testing the mechanical properties of limestone and seaweed pellets, obtained by the discontinuous process and the simulated continuous pelletization process.

Table 3. Aggregate test results of "green" pellets

Sample		Resistance to			Time to desintegration
		impact	pressure	abrasion	
No.	seawead ratio : CaO, %	-2 mm, %	kg/pelet	-2 mm, %	s
1L	50 : 50	19,40	2,65	4,8	25,5
2K	50 : 50	70,24	2,67	0,84	28,9
3L	70 : 30	19,00	9,63	3,0	5,6
4K	70 : 30	5,06	3,51	4,22	7,4
Required value		Max. 5 - 10	Min. 0,5	Max. 3 to 5	As long as possible

CONCLUSION

Tests of mechanical properties of pellets showed that the obtained pellets do not fully meet the usual standards for pellets used in agriculture (for calcification of acid soils), and that among the tested results show the best pellets of sample 4K, obtained by continuous pelletization with the ratio of seawead and limestone 70: 30%. Namely, the impact resistance of 4K pellets was 5.6% (class -2mm, and the maximum allowable value is up to 10%), the pressure resistance was 3.51 kg/pellet (minimum required 0.5 kg/pellet), while the resistance to abrasion was 4.22% (maximum up to 5%), and the time of disintegration in water was very short and amounted to 74 s. The obtained results show that green pellets need to be dried in order to improve their mechanical properties, but this leads to a significant increase in pelletization costs. It is also necessary to expand the tests with other mutual relations of the input components, in order to obtain the optimal ratio for the required quality of the obtained pellets.

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