SOME ASPECTS OF NONFUEL UTILIZATION OF OIL SHALES BASED ON THEIR OXIDATION

VESKI REIN
Institute of Chemistry of the Academy of Sciences of the Estonian SSR, Akadeemia tee 15, Tallinn, USSR 200108

ABSTRACT

Besides their utilization as fuel, oil shales may find use in nonfuel applications, including processes in which end products are obtained by artificial or natural oxidation. By artificial nitric acid oxidation of the organic matter of kukersite oil shale the aliphatic mono-, di-, tricarboxylic and complex polyfunctional acids are formed, with the latter as a by-product. During weathering of oil shales their organic matter becomes alkali soluble. The alkali soluble compounds are of sapropelic origin and are called humic or sapropelic acids and fulvic acids. So, the weathered and partly alkali soluble oil shales may find use as an organomineral ameliorant and fertilizer.

1. An oxidative destruction of oil shales of sapropelic origin and bogheads has been worked out at the Institute of Chemistry of the Academy of Sciences of the Estonian SSR /1/. The novel technology makes it possible to produce succinic (C_4), adipic (C_6) and sebacic (C_{10}) acids and their homologues by oxidation of kukersite kerogen with nitric acid and atmospheric oxygen, traditionally produced from oil (benzene, toluene, cyclohexane, etc.) or vegetable raw material (castor and olive oil, etc.). Manufactured in the pilot plant individual dicarboxylic acids C_4, C_5, C_6, etc., as

well as their mixtures C_4 - C_5, C_6 - C_{10} and others, including methyl esters, successfully passed laboratory and production tests (frost-resistant plastisizers in the form of 2-ethylhexyl diesters, rigid urethane foams, various kinds of artificial leather and coating films, etc.). It has been established that the dicarboxylic acids manufactured from oil shale are high-quality substitutes to adipic and even to sebacic acid, giving polyvinylchloride frost resistance (down to -60 °C). The high quality of plastisizers may probably partly be explained by the presence of tricarboxylic acids C_6 - C_{15}.

2. As a by-product of dicarboxylic acids, polycarboxylic acids have been obtained /2/ having an average molecular formula $C_{45}H_{66}N_2(COO)_{3.4}(COOH)_{4.3}(OH)_{3.9}NO_2$. Plant growth activators are manufactured by neutralization of the latter with an aqueous potassium hydroxide solution or some other alkaline solution, and are used as 0.1 - 0.0001 % aqueous solutions. More frequently the seeds of plants are macerated or plants sprayed or watered with an aqueous solution of the preparation. The oil shale-based plant growth activator has several useful effects on plants. For example, the yield of strawberry and cucumber increases on account of dormant buds /3/. The new stimulant has been officially allowed to testing and has been already successfully tested in many climatic zones of the Soviet Union and in the People s Republic of Bulgaria as well. At present the stimulant is being subjected to state testing.

3. The plant origin of oil shale must be pointed out. Sapropelite and mixed oil shales have been formed from ancient marine and lacustrine sapropels, the latter in turn mainly from lower plants. Modern sapropels as well as peat and brown coals have long been used as fertilizers and organic ameliorants in agriculture. Earlier works concerning the use of oil shales (dictyonema oil shale, Karelian shungites, Azerbaijan shale, etc.) in agriculture are known to a lesser

extent /4/. The use of Hungarian oil shales in agriculture began only recently /5/. But it is even more important to use oil shale to recultivate quarries and terricones which already contain oil shale. Therefore it is necessary to investigate the technogenic weathering processes of oil shales and simultaneous formation of alkali soluble substances.

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