

GREEN CHEMISTRY AND TECHNOLOGY OF PLANT BIOMASS

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ABSTRACT

Plant biomass is abundant, renewable and biodegradable natural material, which involves soft- and hardwood and some other species of terrestrial plants and aquatic plants, as well as residues of forest and agricultural plants, industrial residues of textile, pulp and paper, municipal paper waste, etc. However, chemical technologies of biomass processing, such as production of pulp, microcrystalline cellulose, nanocellulose, bioproducts and some other products are accompanied by a large amount of harmful sewage and gas emissions polluting the environment. In order to turn the chemical technologies of processing biomass into "green", it is necessary to implement the basic principles of green chemistry and technology. In this paper some new green technologies of biomass processing without discharge production waste into the environment are described and discussed.

INFLUENCE OF HYDROLYSIS CONDITIONS ON PRODUCTION OF CELLULOSE NANOCRYSTALLINE PARTICLES

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ABSTRACT

Relationship between concentration of sulfuric acid (C) and temperature (T) required for the cellulose hydrolysis to prepare nanocrystalline particles (NCP) has been studied in this paper. The experiments showed that there is a linear C and T superposition exists, namely: $C = C_0 - nT$. The higher the acid concentration, the lower the hydrolysis temperature should be used, and vice versa. If temperature or acid concentration is lower, there is a tendency to form of microparticles. On the other hand, at higher hydrolysis temperatures, carbonized CNP with decreased yield are obtained. The maximum level of acid concentration that can be used for production of CNP is 60 % at optimal temperature of 45°C. The rod-like crystalline nanoparticles of cellulose produced at these hydrolysis conditions have average sizes of 160 x 14 nm, degree of crystallinity of 75-77% and degree of polymerization of 120-140. The nanoparticles form stable colloidal dispersions in water due to effect of Brownian motion and negative Zeta potential. The economical calculations of production of two cellulose nano-products, paste and beads of CNP, showed that the production of paste is much cheaper. The proposed technology provides the complete utilization of acidic wastewater and their use for the production of valuable by-product such as superphosphate fertilizer, the selling of which covers part of the production cost of NCP. The cheap cellulose nano-product, paste of NCP, was obtained without discharge of production waste into the environment. Furthermore, all washing water is returned in the production line. To reduce the production expenses it is most advantageous to use 60% concentration of SA and relative low hydrolysis temperature, 45°C.

COMPOSITE MATERIALS FOR MANUFACTURE OF WATER DESTROYABLE FORM-FORMING EQUIPMENT

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ABSTRACT

The paper is devoted new materials for the manufacture of water-destructible molding products, for example, foundries used for casting metals and plastics, products like "cocoon" and cases rocket engines on solid fuel. This study can be used to make water-soluble mandrels used in the manufacture of products made of polymer composite materials by winding or laying. At the same time, binders are used that require high curing temperatures under mechanical stress conditions. The analysis of physical and mechanical properties of alkali metal halides is carried out. A reasonable choice of base materials suitable for the manufacture of such articles has been made. The recipe and technology of manufacturing products from water-destructible materials is proposed. The analysis of processes of destruction of these materials after their use is carried out.

SOLUBILITY, DENSITY AND FREEZING TEMPERATURE IN MULTICOMPONENT SYSTEMS WITH POTASSIUM AND CALCIUM NITRATES AND CHLORIDES

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ABSTRACT

The conversion method of production of potassium nitrate from calcium nitrate and potassium chloride is covered by a number of patents, however in industrial scale it is not realized till now. In the majority of patents there are no data on production of calcium chloride from mother liquor that testifies to a number of the difficulties connected to crystallization of this salt. The mother liquors of potassium nitrate production can be used as an anti-icing reagent, a coolant, the heat-carrier in power systems, mineral fertilizer and heavy liquids in a petroleum industry. However in each concrete case the certain completion of their composition is required with the purpose of achievement of necessary physical and chemical and functional properties. The possibility to use mother solution in potassium nitrate production as heavy liquids in oil industry is analyzed. The cuts of the systems $\text{CaCl}_2 - \text{Ca}(\text{NO}_3)_2 - \text{M} - \text{H}_2\text{O}$, with M being mother solution after the crystallization of potassium nitrate, are studied. The density and temperature of solution freezing are identified in homogeneous areas of the cuts. Fundamental possibility to improve the operating characteristics of the mother solutions with the introduction of additional amounts of calcium salts is shown.

**TECHNOLOGY OF ELECTROLYTUM-PLASMA TREATMENT
OF ALUMINUM ALLOYS**

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ABSTRACT

This article presents the results of research on the impact of micro-arc oxidation of structural and phase transformation of aluminum alloy samples. As a result of hardening of a solid solution of copper in aluminum and spot finely divided inclusions are dissolved by micro plasma temperature, phase oxidized form of aluminum corundum. After microarc oxidation an increase in the intensity and broadening of the diffraction lines relative to the initial state is observed; this process improves the quality of the detail during the operation