CONTROL OF SURFACE COMBUSTION RATE OF CHARCOAL PRODUCED FROM WOOD IMPREGNATED WITH CATALYST

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The disadvantages of wooden fuel consist in high temperature of burning (1000-1100^{i}Ñ), the necessity of air excess for CO reduction and high burning rate, which results in the destruction of the most valuable chemical substances abundant in fuel. This necessitates also the use of furnaces with high heat capacity.

The purpose of the present work is to develop surface burning technology for solid fuels with simultaneous extraction of valuable chemical substances using catalysts. The wastes common in production potassium chloride fertilizers were used as catalysts. The developed technology permit us to reduce the wood pyrolysis temperature at charcoal production from 500-520^{i}Ñ to 400-420 ^{i}Ñ and increase the charcoal output by 10-15 %, to reduce both the coal ignition temperature (from 600 ^{i}Ñ down to 400-420 ^{i}Ñ) and the content of CO evolving during burning.

The wastes of wood industry constitute a raw base for chemical and power industry. Only in Belarus, the annual increment of wood biomass is about 20,000,000 m^3, 20-25 % of this amount is utilized.

The industrial wastes of "Belaruskalii" company containing up to 90 % NaCl, 3-4 % KC1 and traces of microelements were used as catalysts.

The essentially important feature of the developed technology is the uniform distribution of a catalyst throughout the wood material. This goal is achieved using the equipment for deep (through) impregnation of wood by either centrifugal or autoclave impregnation. This allows to fill in the wood pores with a solution of the catalyst uniformly throughout the volume.

Wastes of different wood (pine, birch and others) of various sizes, up to the pieces of lumber having 40-50 cm in length and 15-20 cm in diameter, were impregnated. The impregnation was carried out in the treating cylinder using the "vacuum-pressure-vacuum" method. The effect of one of the time-pressure processing regimes on the process parameters is shown in Fig 1, as an example. The 50-80 % absorption (mass %) of the impregnating solution was attained usually.

After the impregnation, the wood was kiln dried and cut into pieces sized 3õ3õ5 cm from different sections of the lumber. The wood samples were put in a sealed vessel, loaded into a furnace and heat treated for 2-3 hours at 400 ^{i}Ñ. The pyrolytic charcoal was investigated by the Thermal analysis (TA) method.

The TA diagrams for the charcoal obtained from natural wood and from wood impregnated with a catalyst are presented in Fig. 2. It is seen that the ignition temperature of the charcoal produced with a catalyst is by 60-100 ^{i}Ñ lower than for the cha rcoal obtained from non-impregnated wood.

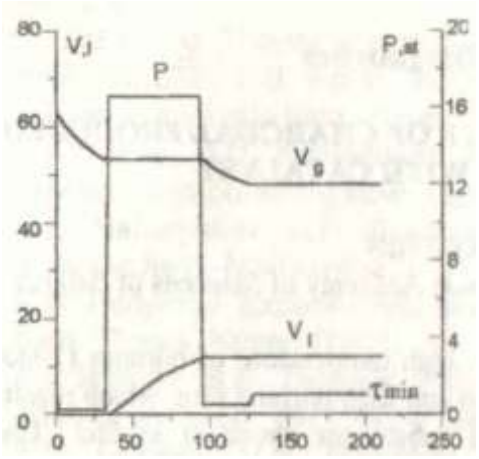
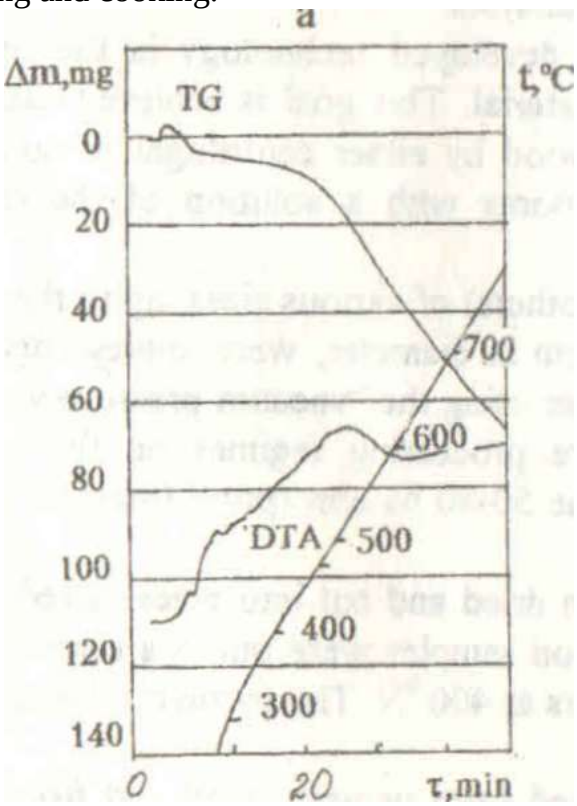


Fig. 1. Wood impregnation with a solution of a catalyst ("vacuum-pressure-vacuum" method).
The volume of pine wood is 0.1m^3,
V_1,V_g are the volumes of absorbed solution and the gas released from wood, respectively(in liters). P is the pressure of the liquid, at.

Forced impregnation under pressure allowed us to reach uniform distribution of the catalyst throughout the cross-section of the lumber. With the steeping method, the surface layers of wood had a higher content of salt than the internal layers. At high-concentrated solution, used for impregnation, the reaction ability of fuel decreases, and at 5 % salt and more the charcoal does not ignite. Therefore the concentration of salt in the wood permits controlling the reaction ability of the fuel.

The catalytically produced coal is easily ignited, steadily bums without smoke and flame, and is nearly disposed of the CO emission. Virtually, CO_2 is the only gaseous product of coal burning. The charcoal of this kind can be used for heating houses and hothouses. The burning of 1 kg coal continues for 20-24 hours. This is convenient for heating and cooking.



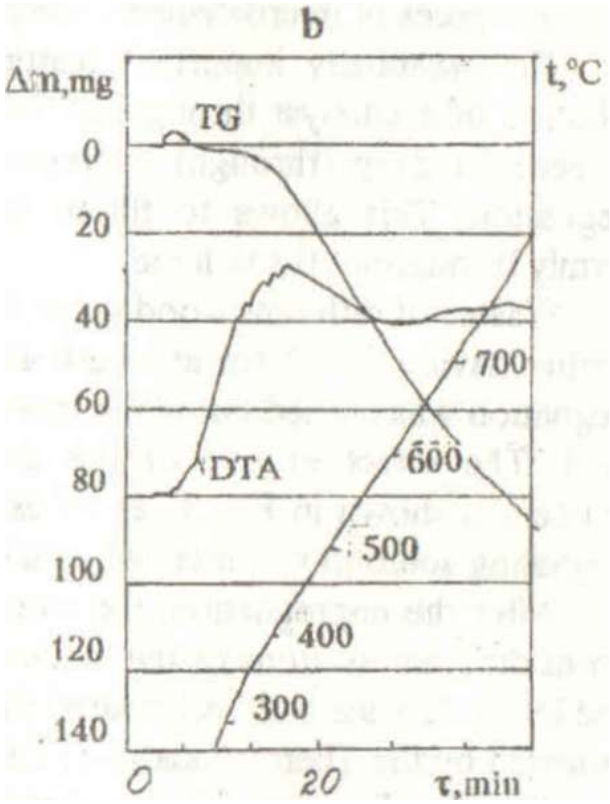


Fig.2 Results of Thermal analysis.

a - natural birch coal (without the impregnation with catalysts),

b - birch coal impregnated with catalysts.

The heating rate is 20 °C/min, the initial temperature is 20 °C, the initial mass is 200 mg.