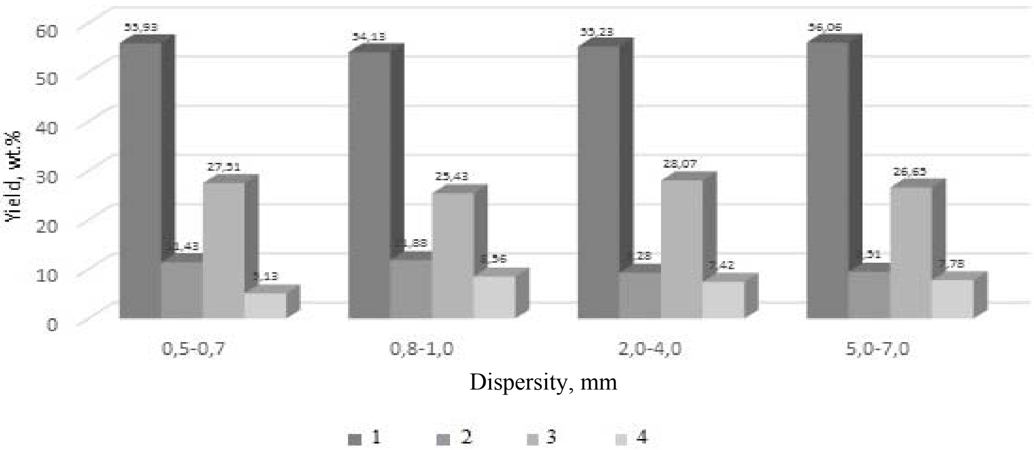

Fig. 8 – Dependence of product yields on the dispersion of rubber treated with liquid nitrogen (WFP:zeolite= 40: 60 (0.67 g), T = 400°C, P = 5-7 MPa, t = 15 min.; PF:rubber = 1: 1). Rows: 1 - total liquid product; 2 - gas; 3 - dry residue; 4 - losses.

Mechanical grinding of rubber crumb after treatment with liquid nitrogen allowed to extract fractions of approximately the following dispersity: 0.5-0.7; 0.8-1.0; 2-4; 5-7 mm, respectively, which were investigated in the reaction of hydrogenation thermocatalytic processing on a WFP catalyst: zeolite = 40: 60 under similar conditions (Fig. 8).

With increasing dispersion of rubber by treatment with liquid nitrogen and mechanical grinding, the catalytic activity of the investigated catalyst increases, which is apparently due to the formation of an optimal active contact surface of catalyst particles and raw materials under given process conditions. The yield of the liquid product varies by about 3 wt.% and ranges from 54.13 to 56.06 wt.%.

So, the cryogenic processing of rubber with liquid nitrogen and mechanical grinding into pieces with different degrees of dispersion under given conditions for carrying out hydrogenation catalytic processing did not have a significant effect on the fractional composition and yield of the products, although it facilitates an easier separation of inorganic constituents and soot from the hydrocarbon part of rubbers. Earlier in our work it was shown that at a degree of grinding of rubbers (tires) 0.4-0.6 mm, the yield of liquid distillate was 56.8 wt.%.[18-22] As a part of the rubber crumbs crushed to dispersion degree 0.4-0.6 the content of 62 wt.% of rubbers (natural and butadiene - styrene), 3 wt.% of soot and 35 wt.% of other components was found.

Polymer crumb (3-6 mm) after treatment for 1-3 days with liquid nitrogen practically did not undergo any changes and was used in a mixture with crushed rubber with a degree of dispersion of 3-6 mm in the hydrogenation thermocatalytic processing on the catalyst WFP:zeolite= 40: 60; T = 15 min; PF: rubber = 1: 1; rubber: plastic = 1: 1 at T = 450°C (Table 2). Thus, recycling of rubbish and plastic wastes on the investigated composite catalysts with preliminary treatment of raw materials with liquid nitrogen and subsequent mechanical grinding allows to slightly change the structure of the organic mass, which affects not only the yield and composition of liquid and gaseous products, but sometimes improves their quality.

Table 2

Dependence of the yield of a liquid fraction of processing of plastic and mixture rubber-plastic (dispersion degree = 3-6 mm; T = 450ºC; catalyst WFP:zeolite with the composition 40 : 60 and 60 : 40; P = 5-7 MPa; t = 15 min.; PF:waste = 1 : 1; rubber-plastic= 1 : 1)

Catalyst WFP:zeolite	V_{gas}, wt.%	Liquid phase, $T_{boiling}$ to180ºC, wt.%	Liquid phase, $T_{boiling}$ 180-250ºC, wt.%	Liquid phase, $T_{boiling}$ 250-320ºC wt.%	Σ liquid phase, wt.%	Weight of dry residue, wt.%	Losses, wt.%
Plastic							
40:60	2.99	10.89	18.43	37.69	67.01	12.0	18.00
60:40	3.64	21.43	5.30	35.63	62.36	13.0	21.00
Rubber-plastic							
40:60	4.99	24.91	25.08	15.98	65.97	13.0	16.04
60:40	4.78	24.10	29.11	8.39	61.60	15.0	18.62