Utilization of Some Industrial Wastes for Producing of Polymeric Composite Materials

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Polymeric composite materials on the basis of some industrial wastes are obtained. Some physical parameters of experimental samples are determined. The analysis of exploitative properties of these polymer composite materials allows recommending them as a heat-insulating material in constructions.

Key words: Ureaformaldehyde oligomer, Loess, Bentonite, Hardener, Industrial Wastes, Environment.

1. Introduction

Rapid development of the industry, development of huge territories has led in some cases to essential deterioration of an environment. One of the major problems now is development and realization of necessary actions for exception of harmful influence of the enterprises on an environment. The large attention is given to problems of analysis of waste products of different chemical and petrochemical production, which can result in an ecological balance disturbance[1].

On the other hand, many waste products of an industry can be used as raw for other purposes. Particularly, the refineries reject in quantities alkaline waste and acid sludges with high contents of sulfuric acids. One of ways of usage of acidic waste of refineries is the creation of new polymer composite materials on their basis. Most perspective are urea-formaldehyde composite materials, since raw for their manufacturing not only cheapest, but also least deficient, and the obtained samples are characterized by the low-level cost and manufacturability. Rational usage and utilization of the waste products also will give huge economic effect.

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2. Experimental Methods

We for a number of years investigate a possibility of obtaining of polymer compositions on the basis of waste of a local industry and application them as building materials. We obtain polymer composite materials on the basis of following initial components:

- Ureaformaldehyde oligomer;
- Bentonite, fractions by the size less than 0,25 mms;
- Marble dust - waste product of processing of marble rock;
- Loess, fractions by the size less than 0,25 mms;
- Hardener - withdrawal of a petroleum-refining industry - acid sludge;

These wastes allow to economize expensive chemical agents, to reduce the cost price and to obtain finished products with the necessary parameters of mechanical and physico-chemical properties. Loess and marble dust contain carbonates and at reaction with inorganic acids release CO_2. Released carbon dioxide will make a composition to be foamed (Fig.1).

Loess, containing organic compounds consisting of humic acids, their composites and salts, promotes formation of coagulative structures in a system Ureaformaldehyde

oligomer-Loess-Filler, and can play a role of the stabilizer of cellular structure.

3. Results and Discussion

We determine physical parameters of experimental samples, which depend on a ratio between components. Thus influencing of concentration and nature of filler on properties of polymer composite materials was studied, which one influence apparent density of the obtained samples. In Table 1 some physical characteristics of samples obtained on the basis of Ureaformaldehyde oligomer (UFO), Marble dust, Bentonite and 20 % solution of hardener are shown.

Increasing of the contents of bentonite results in increase of apparent density and of breaking stress and decrease of a porosity of samples. The decrease of loess at the invariable contents of an Ureaformaldehyde oligomer, filler and hardener results in decreasing a volume weight of samples, however thus is simultaneous decrease the breaking stress almost twice. In similar outcome results the decreasing of marble dust.

One of defect of Ureaformaldehyde composite materials is the emission of formaldehyde during their exploitation. The carried out researches have shown a possibility of an essential decrease of residual formaldehyde in a final product.

In obtained composite materials the nature of a filling material has influence on allocation of free formaldehyde. In fig.2 the relation of the amount of a free formaldehyde (curve 2) and volumetric weight (curve 1) from quantity of a filling material (bentonite) is shown for a sample No 2. As it is visible from a figure, in process of increasing quantity of a filling material, the contents of formaldehyde in samples decreases, and their volumetric weight increases. It is explained, on the one hand, by amplification of process of an adsorption, as the bentonite used as a filling material, is characterized by high adsorptive capacity, and on the other hand, increasing of volumetric weight results in dilution of a system.

Besides, the contents of a free formic aldehyde can also be regulated by a topping temperature variation and increasing of soak period.

Some physical characteristics of polymeric composite materials

No	Structure of composition, Mass Part					Apparent density, kgr/m^3	Porosity, %	Breaking stress, MPa
	UFO	Loess	Marble dust	Bentonite	Hardener			
1	30	15	-	5	20	178	78	0,5
2	30	10	-	5	20	220	65	1,10
3	25	10	-	5	20	210	70	1,00
4	25	5	-	10	20	225	65	1,10
5	30	-	15	5	20	120	85	0,2
6	30	-	10	5	20	140	80	0,4
7	25	-	10	5	20	180	75	0,6
8	25	-	5	10	20	210	70	1,0

Fig.1. The cross-section of the sample of polymeric composite material (in 10x zoom)

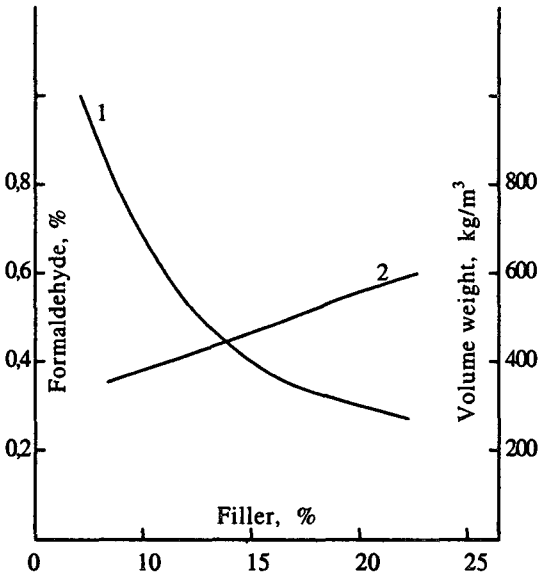

Fig.2. Relation of the contents of formaldehyde and volume weight from quantity of filler

For composite materials used in building, the significant value has residual acid number, because they will be used in a contact with metals. In Table 2 the values of residual acid number for a set of samples are shown.

Table 2. Residual acid number

No	Structure of composition, Mass Part				Acid number
	UFO	Loess	Bentonite	Hardener	
1	25	10	10	10	2,8
2	25	10	5	10	5,6
3	25	10	15	10	2,8
4	25	5	10	10	11,2
5	25	15	10	10	2,6
6	25	10	10	5	2,4

It is possible to considerably reduce a residual acid number and thus to reduce their corrodibility by variation of a structure of composition. For example, at increasing of concentration of loess the residual acid number decreases. It is explained by more full neutralization of hardener by loess which contain carbonates.

4. Conclusions

Our researches have allowed elaborating polymer composite materials on the basis of local raw and wasting of the industries, received on the simplified formulation. The analysis of exploitative properties of these polymer composite materials allows recommending them as a heat-insulating material in constructions.

References

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