



## ANALYSIS OF THERMODISPERSION EQUIPMENT IN THE PROCESSING OF WASTE PAPER MASS

Abidov Komil Zaripovich <sup>1</sup>, Tulaboyev Bekzod Zamonovich <sup>2</sup>

Inoyatov Bekzod Khidirovich <sup>3</sup>

<sup>1</sup> Candidate of technical science, assistant professor, Bukhara Engineering-Technological Institute

<sup>2</sup> Master, Bukhara Engineering-Technological Institute Teacher, Bukhara

<sup>3</sup> Student, Bukhara Engineering and Technology Institute, Republic of Uzbekistan, Bukhara city

<https://doi.org/10.5281/zenodo.4750049>

### ARTICLE INFO

Received: 1<sup>st</sup> May 2021

Accepted: 5<sup>th</sup> May 2021

Online: 10<sup>th</sup> May 2021

### KEY WORDS

*the synthetic material, waste paper, classification, rotation process, thermodispersion.*

### ABSTRACT

*In the last 10-15 years, waste paper materials have formed a wide range of uses for their recycling products. The synthetic material itself is currently undergoing a period of radical technological change, as a result of which the building materials market is being filled with new offers. Suffice it to mention the families of compositions that replace both metal and wood. In turn, waste paper is less interesting in terms of processing as a new and, most importantly, more advanced method of obtaining material. Using this type of technology, the old synthetic structure can be restored. And yet, this line of business of processing enterprises justifies itself for many other reasons, such as environmental and financial.*

**Introduction.** The technologists separate 4 wastes that are recyclable. First of all, these are single-grade wastes in the form of residues and direct waste, which can be added to masses with similar chemical composition. The second category - contaminated single-grade waste papers, for its processing must first carry out technological measures. The third group includes mixed waste paper containing foreign compounds. The basic classification involves the direct molding of products and the separation of molding technology from the semi-finished product. In relation to direct

processing, this group includes polymerization methods; contact molding, mixing and wet wrapping, as well as spraying.

**Research methods.** Methods of molding waste paper products from semi-finished products are also popular. This direction of technological development of processing includes methods of injection molding, extrusion, preregs and molding of premixes. Also, the processing of waste papers is physicochemical and mechanical.



*Figure 1. Preparation of waste paper for processing*

Almost all mechanical methods of processing are aimed at crushing the treated waste by obtaining a homogeneous mass. An important difference between this group of methods is that the resulting product does not differ from the primary raw material in its physicochemical properties. In contrast, physicochemical methods are based on technologies to destroy the structure of the

primary material, which also changes the performance qualities of the substance formed in the process. This is a common operation in the recycling industry and is not limited to waste papers. Depending on the requirements for the final fraction, the corresponding units are connected to the work. Compactors with mechanically driven screw elements can be called universal crushing machines.



*Figure 2. Waste paper collection department*

The waste paper mass loaded during operation is compressed using disc granulator plates with friction mechanisms. As a rule, two plates are used, one of which remains stationary. The processing of waste depends in many respects on the specific properties of the material. Crushers and aggregates equipped with cutters of various shapes are used for solid raw materials. Work with polyethylene waste in the form of a film is carried out using more delicate methods. For example, in a complex line containing compaction, crushing, and granulation units. In this case, the blade elements perform a direct mechanical function of grinding. In part, this phase is related to the preparatory procedures mentioned above. But the separation process is much broader and is not limited to just removing dirt. It is also important to perform separation after grinding, as it is easier to separate the fine grains from

foreign particles. Thus, basic separation still involves the separation of waste paper parts from metal. To do this, magnetic and electromagnetic coils are used inside the rotating structures of the drum, into which the target material is loaded. During the rotation process, small elements of non-ferrous and ferrous metals are left behind by the waste paper and removed through special channels. This leads to the initial processing of waste paper, increasing the homogeneity of their composition. However, with such a separation, some of the waste paper itself disappears. Typically, the share of losses does not exceed 1 percent. Used for washing industrial dishes to remove dirt. The crushed particles are washed under a stream of high pressure water. Sometimes solvents are added to the water to increase the effectiveness of the procedure.



*Figure 3. Waste paper recycling process*

The individuality of the processing is due to the fact that only selected waste paper enters the workplace, which is also ready to mix with the corresponding structural masses. The processing itself is done in a variety of ways, but the extruder is the main one. A special assembly with screws and a feed hopper takes the crushed waste paper, melts it and delivers it to the production line via an

extruder. In the final stage of extraction, depending on the machine, the operator can change the waste paper extraction parameters. The compression coefficient of the raw material is also adjustable, which also allows the selection of the optimal length of the worm to ensure a sufficient amount of uniformity. Waste paper is considered soft in terms of preserving the performance properties of such

processing material, but this does not mean that it can be replicated indefinitely. The fact is that using this technology, one and the same waste paper material can be recycled no more

than 3-4 times, depending on the conditions of use. In the future, the mass will be sent to secondary uses with deeper chemical treatment.



*Figure 4. thermodispersion equipment*

In order to optimize the processing process, another way to reduce the cost of the product has been developed. Multicomponent injection technology is an opportunity to produce these combined products. Its essence is that the three-component product is created by several levels of molding. It is based on a cheap waste paper based on the same unprocessed materials, and then an average quality mass level. In turn, the outer layers are a completely clean environmentally friendly composition, for which the processing of waste paper with an extruder was used. The production of waste paper materials based on multi-component molding is carried out with a technique that allows the waste to pass through several channels. By the way, waste paper is not always used for the inner layer. They are often replaced by a cheaper material containing barium sulfate, talc, ceramics, and the like. Processing should not be aimed at obtaining the same operational and design features that previously described the product. This stage opens up a wide range of possibilities to change the structure by adding special

additions. For example, the processing of waste paper with the addition of ethylene copolymer increases its resistance to mechanical stress and elasticity. If such a compound is included in the polyvinyl chloride composition, then the increase in impact resistance can be trusted. There are not many specialized machines designed to perform operation in full cycle mode. For example, the Reverzer block of the Japanese company Mitsubishi is known in Russia. This is an example of the same extruder equipped with screws and a gas removal device. Local enterprises and British equipment for recycling waste paper are known, their advantages are demonstrated by EPG devices. It is a company that offers innovative ways to recycle waste through extrusion.

**Conclusion.** Nowadays, the synthetic waste recycling industry is especially relevant and in demand in various industries. Getting cheap and practical raw materials at low prices is the main reason for these market participants. However, in Russia, this industry is not yet as



developed as in Europe. Among the most advanced, only the Plarus waste paper recycling plant, which has been operating since 2009, can be singled out. The technological features of this enterprise include the use of a

modern method of recycling PET bottles. At the same time, other enterprises are increasing the production of recycled waste papers in various forms every year.

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