Project:

"Development and production of non-fired building binder and vulcanized mastic based on biopolymers".

Market segment: Market for sealants, mastics, building products (roofing tiles, facing slabs, blocks, paving slabs), thermal insulation composite products (like wood chipboards, fibreboard); recycling of industrial and agricultural waste.

1. Description of the product.

1.1. Vulcanizable thiocol-like sealants, mastics for construction, repair, waterproofing, anticorrosion coating of pipelines. Polysulfide and thiol groups in the polymer will be obtained from elemental sulfur by the mechanochemical reaction in the mill, without the formation of waste, without using solvents as the reaction medium, and not by the interaction of aliphatic chlorine derivatives and sodium polysulfide, as in analogues, when the reaction is carried out in an aqueous solution using dispersants and emulsifiers, dipolar aprotic solvents. In the analogues, large volumes of toxic water effluents are formed.

1.2. Vulcanizable thiokol-like mastics based on a number of biopolymers – wastes: lignin, grain wastes (shells released by threshing of cereals, legumes, oilseeds, also rods of corn cobs), feathers of domestic poultry, also based on peat. The technology proposed for development will lack waste and industrial effluents; the powder product obtained mechanochemically in the mill will be combined with a diluent without washing to form a suspension in the form of a paste — the desired product. The technology proposed for development will involve a high-energy mill, and the construct of the laboratory mill will reproduce the construct of an industrial mill. Experimental results will be possible to scale for industrial production. The innovative product will be capable of vulcanization of the type of thiokol under normal conditions, and therefore can be used in building.

1.3. The non-fired non-clinker building binder, similar in strength and water resistance to portland cement or fiber cement, for the manufacture of roof tiles, facing facade tiles, building blocks, paving slabs.

As an analogue can be considered building sulfur concrete. The building sulfur concrete is produced by melting and heating of modified sulfur to 150 ° C, when toxic hydrogen sulfide can be released if the process conditions are violated. Therefore, numerous concrete products plants will not be able to produce their blocks from such sulfur concrete in the usual way, like from portland cement, and there is currently no demand for such sulfur concrete in Russia.

The proposed for development technology of a building binder based on sulfur and technogenic waste will provide a building binder, used in the same way as portland cement: at normal temperature, in the form of a plastic water mixture. On its basis, in the usual way at any concrete products plant, on the same equipment, it will be possible to prepare concrete that hardens in air at normal temperature and is suitable for the manufacture of concrete products (tiles, facing facade plates, etc.).

The products described are combined by the fact that they will be produced mechanochemically on the same equipment, as well as using elemental sulfur as one of the initial components, which is a by-product of oil and gas refining.

An important feature of the technology group is environmental friendliness; products will be synthesized by the reaction in the mill, without the formation of waste, without the use of solvents as the reaction medium, without the formation of industrial effluents.

The development company will be able to produce and supply mini-plants for processing agricultural waste, as well as industrial waste, associated sulfur, low-demand organic synthesis and oil refining products into the above-mentioned commercial products.

2. Problem solved by the project.

2.1.This is the utilization of elemental sulfur, from which natural gas and oil are cleaned, and the overproduction of which is a global problem, and it is the main deterrent to increasing production for Russian gas producing enterprises. The target audience of the project will be refining units of gas producing and oil producing companies (in particular, the Russian companies Gazprom, Rosneft), which are interested in introducing sulfur utilization technologies. Also, the utilization of sulfur is of interest for the company Norilsk Nickel.

2.2. The production of thiokol-like vulcanizable mastics and sealants also solves a number of the following problems.

2.2.1. Partial import substitution of thiokols - polysulfide rubbers not currently produced in Russia, which are the basis of thiokol sealants vulcanizable under normal conditions used in building, shipbuilding, and aviation.

The target products of the innovation technology will be: vulcanized mastics, sealants. At the same time, not ready-made mastics and sealants can be made, but powder components for sealants (thiokol, acrylic), which will be supplied to leading Russian manufacturers of sealants, for the sake of import substitution and cost reduction. The interest in testing specimens was expressed by the leaders of two large Moscow firms producing sealants. Therefore, Russian sealant manufacturers will not be competitors for an innovative project, but buyers and partners. They will be able to partially replace expensive components with an innovative product in a number of formulations of thiokol and acrylic sealants, in order to reduce costs.

In Russia, about 20 thousand tons of thiokol sealants, about 160 thousand tons of bitumen mastics are used per year. Eco-friendly innovative vulcanized mastic will have to move into the market in order to occupy a niche of bitumen mastics that are hygienically exceptionable.

2.2.2. This is the recycling of lignin, a large-capacity waste of cellulose and hydrolysis productions, accumulated in the dumps of fifty Russian hydrolysis plants for many decades. Each dump is several million tons, occupies several tens of hectares, worsens the ecological situation.

2.2.3. This is the disposal of agricultural waste: grain waste, feathers of poultry. For example, in Russia about 2 million tons of sunflower husk are generated annually; poultry enterprises generate about 128 thousand tons of feathers per year. Enterprises incur costs for disposal of waste at landfills or the cost for incineration in boiler houses. And this leads to an increase in production costs.

2.2.4. Processing of low-demand petrochemical and organic synthesis products utilized by incineration in boiler houses: resins, distillation residues.

Thus, organizations that have the aforementioned wastes will be able to acquire mini-plants for processing waste into commercial products and a license to manufacture using this technology.

2.3. Production of non-fired non-clinker building binder also solves a number of problems.

2.3.1. This is a rejection of the technological operation of firing the raw mix at 1450 ° C (clinker synthesis in the production of portland cement), time consuming and expensive to fuel.

2.3.2. Utilization of large-tonnage mineral industrial wastes: pyrite cinder (waste production of mineral fertilizers), slag (metallurgical, steelmaking, ferroalloy).

2.3.3. Utilization of large-tonnage solid waste generated in the production of vegetable oils: spent bleaching bentonite clay, spent diatomaceous filter powder after

oil refining. Enterprises face the problem of disposing of these wastes at landfills for municipal solid waste, due to their pyrophoricity.

The target audience of the project will be concrete products plants, which will be able to produce from innovative binder their construction and insulation (porous) products: roof tiles, blocks, tiles, siding panels, paving slabs.

3. What is the uniqueness of the project?

In innovative industrial technology, biopolymers that are industrial or agricultural waste will be used as feedstock, and they will be modified to give them new properties (for example, hydrophobicity), their useful properties (chemical resistance, elasticity) will be used. Chemical modification of the raw material, its dispersion to the desired structural characteristics, depolymerization and polymerization will be carried out in a high-energy mill, without using solvents as a reaction medium, without generating waste. Mechanochemical technology will be environmentally friendly and resource-saving.

4. Target audience:

The target audience should be divided into product buyers and technology buyers.

Technology products: vulcanized mastic, building binder will be available in retail for private construction of houses and landscaping.

Also, the target audience will be building companies and concrete products plants, which will be able to produce from innovative binder their products: blocks, roof tiles, siding tiles, gutters, curbs, paving slabs.

The target audience of the project will also be manufacturers of sealants, who will be able to buy components for innovative sealants (thiokol, acrylic); chipboard manufacturers who will buy an environmentally friendly binder for their boards.

The target audience - technology buyers will be gas producing organizations, for which the utilization of elemental sulfur, from which natural gas and oil are cleaned, is important, and whose overproduction is a global problem. For Russian gas producers, the accumulation of associated sulfur is the main deterrent to increasing production. The buyers of the technology will be organizations engaged in oil production and gas production, interested in utilization of associated sulfur accumulated in dumps (for example, processing units of Gazprom, Rosneft). Norilsk Nickel is also interested in the introduction of sulfur utilization technology. They will profit from any part of their sulfur processed by innovative technology.

The buyers of the technology will also be large agricultural companies interested in processing their grain waste, waste of vegetable oil production, and poultry waste into construction materials.

5. Monetization of the project.

The mini-plant to be created for this project will be a show-room, a demonstration stand, which will show the possibilities of processing large-tonnage waste: agricultural waste (sunflower husk, rods of corn cobs, poultry feather) or industrial waste (elemental sulfur, phosphogypsum) in popular commercial products. Representatives of large agricultural holdings, representatives of oil-producing, gas-producing and oil-refining companies will be invited to familiarize themselves with the possibilities of experimental production in order to offer these firms to acquire and place such plants for processing their problematic waste on their base. Owners of lignin dumps and peat developments may be interested in cooperation.

It is known that for gypsum products, non-waterproof and not strong enough, with low frost resistance, it is difficult to compete with concrete products based on portland cement. Therefore, representatives of gypsum plants (and any owners of gypsum quarries) can be invited to the show-room to be interested in the possibility of

modifying (waterproofing and reinforcing) gypsum binder with innovative additives to increase the strength and water resistance of gypsum products.

Most Russian wood chipboards do not meet international quality standards due to the high toxicity associated with the release of formaldehyde into the indoor air from urea-formaldehyde resins used as a binder. Therefore, owners of woodworking plants, plywood factories can be interested in the possibility of developing and introducing non-toxic and cheap polymeric binder based on lignocellulosic raw materials for furniture and heat-insulating particle boards. Innovative binder, which is vulcanizable under normal conditions, will allow the process of pressing plates without heating, which will make production more economical and environmentally friendly. Moreover, lignocellulosic raw materials (sunflower husks, cereal husks) can be not only the basis of the binder polymer, but also the filler of composite structural and heat-insulating plates.

Based on the annual production of particle boards by large Russian factories in the amount of about 4,400 thousand tons, the need for polymer binder for this product is about 354 thousand tons per year.

Roofing tiles, facing facade plates, gutters, curbs, paving slabs can be produced from an innovative building binder. But in addition to the innovative raw mix for these products, the mini-plant will be able to produce activated mineral powder for road asphalt concrete. The quality and frost resistance of the road surface is an eternal Russian problem. Mineral powder is a necessary component of high-quality asphalt concrete, introduced into its composition in the amount of 8 ÷ 11% wt. In a number of Russian regions there is no extraction of limestone - the raw material for the production of mineral powder. Therefore, representatives of asphalt concrete plants from various Russian regions can be invited to the show-room to demonstrate how activated mineral powder can be obtained at a mini-plant by grinding samples of local mineral raw materials brought by them: quartzite, or river sand, or dolomite, or metallurgical slag and other industrial wastes. According to the results of the

demonstration, managers of asphalt concrete plants will be offered to purchase a mini-plant for the production of mineral powder from local raw materials to meet the needs of the enterprise.

The activated mineral powder can be sold to concrete products plants at $ 30 per ton to replace 15% of the cement in the concrete. For example, at a cement cost of $ 74 per ton, a concrete products plant or a house-building factory will have savings of $ 6.6 per ton of cement.

There is a composition and production technology of activated mineral powder from quartz sand, a patent, technical conditions, test reports.

6. The approximate payback period of the project.

During the first year from the beginning of the launch of the innovative project, an experiment will be conducted on the development of innovative product compositions in the laboratory. At the same time, the mini-plant equipment will be installed at the production site.

The mini-plant will start producing an innovative product one year after the launch of the innovative project. And the project's timeline for payback will be 1 year after the launch of the mini-plant (after the start of production of the product), 2 years after the launch of the innovation project. However, a mini-plant can be created in a short time and can start producing mineral powder before completing experimental work in the laboratory to develop innovative product formulations. Then the project will have a payback period of less than two years.

7. The amount of the planned investment.

At the time of the start of the project, the amount of investment should be from $ 144,000 to $ 273,000. These funds are necessary for conducting an experiment in a laboratory and creating an industrial enterprise. The cost of the mini-plant equipment will be determined by the annual production volume of the powder product. Industrial

equipment will cost between $ 115,000 and $ 179,000 with production from 7 to 17.5 thousand tons per year.

One year after the launch of the project, an additional investment in the amount of $ 151,500 to $ 303,000 will be required. These funds are needed to recover the production costs for one year.

Total investments will be from $ 295,500 to $ 576,000, depending on the volume of production.

The investor is invited to invest the project at 100%.

The investor will establish the profit share for the investor, also the investor will receive ownership of patents on the composition and the developed technology.

Internal rate of return IRR = 18%.

8. Region of the project.

Place of project implementation - any, at the request of the investor. The Russian part of the project can be implemented preferably in the south of Russia (Belgorod, Voronezh, Rostov, Stavropol Territory, Krasnodar Territory), based on considerations of the proximity of raw materials - from the presence of large agricultural enterprises; also based on the proximity of the source of sulfur, gas enterprises in Astrakhan.

9. Competitive environment.

The target products of the innovation technology will be: vulcanized mastics, sealants. At the same time, not ready-made mastics and sealants can be made, but powder components for sealants (thiokol, acrylic), which will be supplied to leading Russian manufacturers of sealants, in terms of import substitution and cost reduction. The interest in testing specimens was expressed by the leaders of two large Moscow firms producing sealants. Therefore, Russian sealant manufacturers will not be competitors for an innovative project, but buyers and partners. Those firms that refuse to introduce innovative components will become actual competitors.

In Russia, about 20 thousand tons of thiokol sealants, about 160 thousand tons of bitumen mastics are used per year. Eco-friendly innovative vulcanized mastic will have to move into the market in order to occupy a niche of bitumen mastics that are hygienically exceptionable.

Roofing tiles, facing facade tiles, blocks, gutters, curbs, paving slabs can be produced from an innovative building binder. Russian cement plants, which produce about 60 million tons of portland cement per year, will consider the factories that appear in their immediate vicinity, producing a similarly applicable binder, as competitors. But Russian large cement producers, as a rule, work on old equipment, using old technologies, and are reluctant to decide on technical re-equipment, due to the long payback periods. Therefore, if new mobile mini-plants, producing about 8 ÷ 17 thousand tons of innovative binder per year, will work on the composition and properties according to the specifications of concrete products plants, they will be able to compete with traditional manufacturers of portland cement.