

COMPLEX TECHNOLOGICAL SYSTEM OF CRUSHING – FINE GRINDING – PNEUMATIC SIZING FOR INDUSTRIAL MINERALS WITH LOW AND MEDIUM HARDNESS FOR THE MANUFACTURING OF COSMETIC PRODUCTS AND FOOD – SUPPLEMENTS

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This project was proposed by a consortium that includes *S. C. MINESA MINING RESEARCH AND DESIGN INSTITUTE S.A. Cluj – Napoca* and *AGRICULTURAL SCIENCE AND VETERINARY MEDICINE UNIVERSITY (USAMV) Cluj-Napoca*. The main objective was the design and the implementation of a complex system of crushing / fine grinding and pneumatic sizing of industrial minerals, used in the manufacture of cosmetic products and food supplements.

The technology designed and implemented in the Project consists of several modules: inter-phase transport, crushing and grinding of raw ore, drying in a temperature and time-controlled environment, crushing / fine grinding and pneumatic sizing, physical and chemical analysis and quality control, packaging, calibration and labeling, temporary storage of finite products before delivery to the beneficiary. With minimal technological changes, the process can produce fine grinded products that are chemically inert and sterile and have strictly controlled granulometric structures ranging from 0 – 15 microns to 0 – 60 microns. Under certain conditions, up to 140 microns can be obtained.

Keywords: fine grinding, cosmetic products, fibroblasts

Introduction

The paper presents the final stage of the researches performed in the Project “Research regarding the manufacturing of fine grinded competitive industrial minerals, requested in the cosmetics and food industries, by designing and implementing of performing processing systems”, project which is part of the NATIONAL PLAN FOR RESEARCH – DEVELOPMENT AND INNOVATION II 2007 – 2013, INNOVATION

PROGRAM NO. 5, coordinated by AMCSIT – POLYTECHNIC UNIVERSITY Bucharest, developed in 2007 – 2009, with the economical effects finalization in the 2010, and it is a following of the article (1) published in the Mining Magazine no. 1/2009.

Since 2000, at the economic agent continuant request, whit holds an important position in the internal market of cosmetics industry, SC MINESA Mining Research – Design Institute SA Cluj – Napoca, has started to produce 3 – 4 types of fine grinded clay, with well defined granulometric structures, in the Micro production Station,. The economic agent as beneficiary uses these types of fine grinded clay for manufacturing a wide range of cosmetic products and some food supplements. Unfortunately, because of the advanced rate of ware of the technologies equipment, overcome both physical and moral, obtaining the clay types at the strict qualitative conditions requested by the beneficiary, was accomplished with great efforts and high costs. The beneficiary has continued soliciting higher quantities, practically very hard to obtain given the existent endowment (the fine grinded clay solicited had exponentially grown, reaching from 5,000 kg in 2000, at 50,000 kg in 2007). Because of the high costs requested for processing these types of clay, the benefit was insufficient for obtaining, if not the endowment with modern technology, at least modernization of the existent one.

Having a supplementary benefit as part of a co-financed budget Project, SC MINESA Mining Research – Design Institute SA Cluj – Napoca, has proposed to obtain a processing technology for industrial minerals, with the final purpose of obtaining fine grinded products, used in the cosmetic industry and the manufacturing of food supplements.

The technology was especially based on the field of obtaining fine grinded final products as **clay** and **volcanic tuff**, this approach was not limitative, and it was ended with achieving a technology that could also be used, with minimum accommodation, for fine grinding other industrial minerals with similar physical – chemical properties, and with adjacent use area like talc,

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calcite, dolomite and limestone, kaolin, diatomite, etc.

Technology description

The processing technology founded, designed and accomplished according to the Project, is a modular technology comprised of the following functional modules: inter-phase transport, crushing and grinding of raw ore, drying in a temperature and time-controlled environment, crushing / fine grinding and pneumatic sizing, physical and chemical analysis and quality control, packaging, calibration and labeling, temporary storage of final products before delivery to the users. Based on the specific requests of the consumers, with minimal technological changes, the process can produce fine grinded products that are chemically inert and sterile and have strictly controlled granulometric structures ranging from 0 – 15 microns to 0 – 60 microns, and under certain conditions, up to 140 microns can be obtained.

Emplacement, installation and operation of the technological equipment

The technological equipment was located into an existing building, out of service, in a space limited by closing up with full and glassware panels, used for separating the surrounding spaces. There where installed two dusting installations, equipped with performance hardware for capturing and retaining mineral dusts. By applying the last two measures there was created the optimum condition for performing the productive process, assuring the safety and microclimate conditions and for manufacturing the necessary raw materials and obtaining the cosmetic and food supplements products, and with positive impact on the environment and health of the working staff.

Fig. 1 and 2 are pictures of the drying installation, and the fine grinding and pneumatically sizing installation.

After finalizing the processing equipment installation and the run on empty and on load, there where performed technical adjustment works for the optimum work parameters determination. So, the technical parameters and the production capacity where determined for manufacturing three types of clay (Type I with 0 – 20 microns granulosity, Type II with 0 – 40 microns granulosity, Type III with 0 – 60 microns granulosity).

The production capacity accomplished by the technology implementation, based on the fineness requested by the final products, varies between 50 – 80 kg / h, and is dictated by the fine grinding –

sizing modulus capacity. The installation may function for 3 shifts – 7 working hours per day, with approx. 1 hour break per shift, for control, repairs and technological adjustments.



Figure 1 Drying installation



Figure 2 Fine grinding and classing installation

The no. 1 Partner, *AGRICULTURAL SCIENCE AND VETERINARY MEDICINE UNIVERSITY (USAMV) Cluj-Napoca*, has accomplished the particles spectroscopic print characterization Uv – Vis FT – IR, such as and in different types of suspensions; particles size and dispersion degree assessment in cellular culture mediums (fibroblast), by microscopically methods, cyto-toxicity in vitro study on leukocyte and fibroblast cellular cultures, for the fine grinded mineral products obtained on the designed and implemented technology, according to the Project. There were performed analyzes on clays response, in natural and fine grinded form on the cellular systems by measuring up the cyto-toxicity markers. The cyto-toxicity in vitro study was realized on leukocyte cultures (experimental variant for oral administration). For testing the bio-stimulating capacity, or the cell proliferation inhibition due to the fine grinded clays, fibroblastic – epithelial (RPE – D407) cells where used. The tests performed on two clay samples (fine grinded in two different variants Type I with 0 – 20 microns granulosity, Type III with 0 – 60 microns granulosity), have demonstrated, both on the leukocyte cells and fibroblastic cells, the lack of cyto-toxicity. So, the conclusion is that **these clays can be used as ingredients and additives in the orally and direct dermal**

administrated products (cosmetic and dermatological products).

The industrial lot production

After the optimum processing conditions determination and according to the results obtained in the laboratory research stage, and with the tests results for the potential users of the technology's products, the finale products lot was started.

For 2009 there was a firm order for the production of 50,000 kg fine grinded clay, Type III, use in manufacturing cosmetic and food supplement products. As a result, the production of this type of clay was initiated, using the complex technology of crushing, graining, drying, fine grinding and pneumatic sizing, designed and performed according to the Project. By the end of the last stage of the Project, there where 6,900 kg Type III fine grinded clay manufactured and delivered to the beneficiary. The fine grinded clay production has continued until the end of 2009, with a total quantity about 42,000 kg.

The fine grinded clay lot production has testified the optimum processing parameters determined in the technological adjustment stage, the differences from those parameters being insignificant, with values below 1% in regard to the optimum values. So far, the beneficiary had no complains related to the quality of fine grinded clays lot delivered.

As an additional advantage and very important for the research beneficiary - SC MINESA Mining Research – Design Institute SA Cluj – Napoca – is the acquisition and the implementation of a modular complex technological line for crushing – fine grinding – pneumatic sizing, under strict condition related to the food and cosmetic products safety for human use, which will serve as a research base for future developments.

As a result of the Project specific Innovative process, the invention proposal no. A/00587/28.07.2009 was registered at OSIM Bucharest, with the title: “Modular fine grinding technology for industrial minerals with low and medium hardness”, applicant: SC MINESA Mining Research – Design Institute SA Cluj – Napoca and

titular: SC MINESA Mining Research – Design Institute SA Cluj – Napoca.

Conclusions

1. The processing technology, founded, designed, and implemented according to the Project, is a modular technology, comprised of several functional modules, the number of the modules and their activation sequence depends on the processed mineral materials, and on the finale products quality.
2. Based on the consumers specific requests, with minimum technological changes, fine grinded industrial minerals can be obtained and these minerals are chemically inert and sterile, and have strictly controlled granulometric structures ranging from 0 – 15 microns to 0 – 60 microns, and even up to 140 microns, under certain conditions
3. Following up the performed studies, USAMV Cluj – Napoca has established that **these clays can be used as ingredients and additives in the orally and direct dermal administrated products (cosmetic and dermatological products).**

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