

# SYNTHESIS AND TESTING CATALYSTS BASED ON FLY ASH FROM THERMAL POWER PLANTS AND NATURAL ZEOLITE FOR GAS EMISSIONS PURIFICATION AND CATALYTIC PROCESSING OF HEAVY OIL

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## ABSTRACT

In this study, hollow microspheres based on fly ash from the Ekibastuz coal field (Kazakhstan) and natural zeolite from the Taizhuzgen field (Kazakhstan) were used for the synthesis of catalysts. The catalysts were tested in the process of sulfur dioxide oxidation with different SO<sub>2</sub> content in the SO<sub>2</sub>-Ar gas mixture at a flow vortex plant of the “Emulsifier” type with a capacity of 2 m<sup>3</sup> / h. Technology for the oxidation of SO<sub>2</sub> with oxygen in an aqueous solution has been developed and the best technological parameters for the selective oxidation of SO<sub>2</sub> with the production of sulfuric acid as a product have been determined. The degree of SO<sub>2</sub> sorption is reached up to 95%. Also, the prepared catalysts were tested in the process of redox-catalytic cracking of fuel oil (with preliminary electromagnetic excitation of hydrocarbon molecules) to obtain light carbon fractions. The fuel oil of the Amangeldy Gas Processing Plant (AGPP, Kazakhstan) of the M-100 brand was studied as a feedstock. On the optimal catalyst in the products of oxidative cracking of fuel oil, the fraction of light gas oil makes up the main part. The resulting light gas oil contains a significant amount of alpha-olefins, which are scarce raw materials for the production of synthetic additives and oils.

**Keywords:** Fly Ash, Natural Zeolite, Water and Gas Purification, Highly Toxic Organic Compounds, Catalytic Cracking, Fuel Oil.

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## INTRODUCTION

The problem of the utilization of ash and slag of the Thermal Power Plants (TPP) or CHP working on solid fuel is very urgent. Fly ash contains several components with valuable and unique technological properties: aluminosilicate hollow microspheres (AHM, which are the most original and perhaps the most valuable components of ash), magnetite microbeads, the unburnt carbonic particles, ferrosilicon and carbonate microspheres.<sup>1-5</sup> The value of AHM is determined by the fact that they can be ideal fillers. The main components of ash and slag are SiO<sub>2</sub> (up to 60%) and Al<sub>2</sub>O<sub>3</sub> (up to 25%). The content of Fe<sub>2</sub>O<sub>3</sub> is up to 15%, of CaO from 1.5 to 4.5%, of K<sub>2</sub>O from 2.0 to 4.5 %. AHM is in great demand in many countries and ash dumps are technogenic deposits of valuable products.<sup>2,3,6,7</sup> Features of the chemical and mineral-phase composition of cenospheres make it possible to synthesize microspheric fuel cracking catalysts based on them.

Thermal power plants, oil and gas processing plants are among the most important sources of atmospheric pollution: the atmosphere is polluted by emissions of sulfur and nitrogen oxides, carbon monoxide and its accompanying benzopyrene, and other harmful compounds, most of the emissions are toxic.<sup>8-12</sup> Gas treatment plants of CHP, as well as methods associated with structural changes of the unit, as a rule, are very expensive and not always economically justified. Therefore, it is very important to develop low-cost