WAYS OF DEVISING LOW-WASTE TECHNOLOGY IN UNITS FOR FREEING GAS-AIR MIXTURES FROM HYDROGEN SULFIDE AND CARBON DISULFIDE

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In reconstructing old plants and building new ones, questions of protecting the environment and using natural resources should be solved comprehensively. As analyses of discharges from plants in the chemical industry have shown, significant amounts of hydrogen sulfide and carbon disulfide are entering the atmosphere, which exceed the maximum allowable discharge (MAD) of these substances for a factor of 5-10. In this connection, the problem of devising low-waste or waste-free technologies in man-made fibre plants is becoming especially acute [1, 2]. Special weight is being given to increasing the efficiency of operation of units for freeing gas-air mixtures (GAM) from hydrogen sulfide and carbon disulfide.

It is well known that the process of freeing GAM from sulfur-containing compounds is performed in two stages: in the first, purification from H₂S; in the second, from CS₂.

Freeing GAM from H₂S is effected by an absorption method, with an alkaline absorbing solution, using catalysts—hydroquinone or disodium (cobalt phthalocyaninedisulfonate (CPCDS). The process is carried out in horizontal scrubbers, with spray irrigation, at a velocity of the GAM stream in the scrubber of 1-3 m/sec and an irrigation density of 3-5 m³/(m²·h). The main oxidation products of H₂S are sulfur and sodium thiosulfate. Thereupon the sodium thiosulfate content of the solution constantly rises, reducing the absorbing power of the solution with respect to H₂S.

To prevent this decrease in absorbing power of the solution, a part of it (20-50 m³/day per gas purifier) is withdrawn from the circulation system—on reaching a sodium thiosulfate concentration of 180-250 g/liter in the solution. To maintain a constant volume of absorbing solution which circulates in the system, the calculated amounts of soda, alkali, catalyst, and water are added to the solution. At present, the absorbing solution which is withdrawn from the system is not utilized, which leads to contamination of water reservoirs, impairment of the operation of biological clean-up units, and losses of a valuable raw material—soda, catalysts, and the products obtained (sulfur, and sodium sulfate and thiosulfate).

On transition of units for freeing GAM from H₂S to a low-waste technology, problems of utilizing sodium thiosulfate, sulfur, and sodium sulfate will be solved, plus the problem of reducing the losses of valuable raw material used in preparing the absorbing solution.

Thus, the process of utilizing sodium thiosulfate from wastewater for gas-purification units which has been developed by the NIIOGAZ together with the "Khimvolokno" Sci.-Ind. Assoc. for man-made fiber plants is being introduced at present into the "Sibvolokno" plant. The fundamental technological scheme and description of the process have been given in [3].

The sulfur utilized from hydrogen sulfide purification unit wastewater may be produced in the form of melted flake sulfur or in the form of a sulfur paste for the manufacture of acaricides or fungicides (media for protecting plants from pests and ailments).

In most of the plants in the subbranch, the finely-dispersed sulfur formed in the process of freeing GAM from H₂S is melted in autoclaves at about 150°C and poured into ingots, and the commercial product is obtained in the form of melted sulfur in bars. However, the amount of sulfur which is melted up in various plants of the sub-branch varies significantly; the losses of sulfur in individual plants amount to 40% or more (amount of melted up sulfur referred to the amount of sulfur formed).

As has already been noted, the sulfur can be also obtained in the form of such commercial products as: flaked sulfur or colloidal sulfur paste for the manufacture of acaricides or...
fungicides. In the preparation of flaked sulfur (the process has been realized in other branches of the industry), the sulfur paste after the vacuum filters of the gas-purification unit is routed to a continuous melter, where it is melted with steam (at about 150°C), then it is cooled on a drum cooler, and is cut off from its surface with a knife, in the form of flakes. The commercial product—flaked sulfur—is routed to the warehouse (for man-made fibre plants, the method of preparing flaked sulfur has not received circulation).

As concerns technology for preparing sulfur paste for manufacture of acarofungicides, before passing to a description of it, it is necessary to note the following. The valuable fungicidal and acaricidal properties of finely ground sulfur (natural) have been known for a long time. Sulfur heals plants from such ailments as powdery mildew and favus, and kills mites which ruin apple orchards and currants, while remaining harmless both for man and also for animals and birds. Nevertheless, sulfur is rather rarely used for agrotechnical purposes, since it is effective only in the finely ground state, where its particle size is not over 50 μm. It is rather complicated to prepare sulfur with particles of this size from natural sulfur; moreover, particles of finely ground natural sulfur are poorly retained on plant leaves. It is not known what would have been the fate of this effective preparation if new sources of sulfur-containing raw material had not been found, one of which is plants for the manufacture of viscose fibre.

In a study of the possibility of going over to low-waste technology in units for freeing GAM from H₂S in plants for viscose fibre manufacture, it was found that, in the absorption of H₂S by the absorbing solution, a finely dispersed sulfur is formed having a particle size less than 50 μm. Further studies conducted by the "Khimvolokno" Sci.-Ind. Assoc. together with the NIIOGAZ showed the possibility of using it to prepare a preparation with acaricidal and fungicidal properties. Technology and apparatus design for the preparation of a sulfur paste having the assigned parameters have been worked out for the Kalinin "Khimvolokno" Sci.-Ind. Assoc. Technology for the preparation of the acarofungicide "Sul'farid," which is based on the sulfur paste from gas purification units of the viscose industry has been developed by the Moscow branch of the VNIIKhMproekt together with the Shchelk plant of the VNIKhSZR, the "Khimvolokno" Scientific-Industrial Association, and the NIIOGAZ. The process of preparing this preparation has been assimilated into the VNIKHSZR Shchelk plant.