UTILIZATION OF PRODUCTION LIQUID WASTES WITH THE USE OF HIGH-TEMPERATURE ENERGY OF DEVIATING GASES

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The utilization technology of production liquid wastes with the use of high-temperature energy of deviating smoke fumes is proposed. The apparatus constructive peculiarities with fluidized bed are given. The technology can be used on the heat power plants.

The apparatuses with fluidized bed (FB) are recommended for utilization of production liquid wastes. The wide use of FB process in the different sectors of industry for diverse technological processes, wide range of productivities of single apparatus, different approach ways to process engineering design cause the appearance of whole set of modifications of quasi-liquefaction method and apparatus constructions [1,2]. The following characters of FB apparatuses can be emphasized.

1) The apparatus configuration in FB band can be cylindrical, cylindrical-conical, square, rectangular ones. There are apparatuses with two or more bands, with step change of area of section by the height and etc.

2) The construction of gas-distribution lattice is carried out in the form of plane plate with holes or cracks, caps, nozzles for the introduction of fluidizing agent of failed or non-failed types and etc.

3) The introduction of initial material in FB apparatus can be carried out under the bed or below bed level in the one point or distributed. The different feeders, spreaders, burners, which are mechanical, pneumatic, combined ones, are used for this.

4) The output of dry material is carried out on the different levels of FB (upper, lower, and intermediate). The installations with total output of dry product from FB of inert particles are known.

5) The heat application to apparatus also can be different. In many cases the fluidizing agent is heat-transfer-agent, the part or whole heat can be supplied by the firing in apparatus, in some cases part of heat is transformed through heat-exchange surfaces.

The listed abilities don't exhaust the whole variety of the method and FB apparatus constructions. The descriptions of new methods and apparatus types regularly appear in literature.

The character temperature balancing of heat-transfer agent and level on small distance from gas-distributed lattice, which don't exceed 40 mm at heat loadings $2\div3\cdot10^6$ kkal/m^2·h is established for fluidization process. From this point of view, it is rational to carry out the process at maximum possible heat-transfer agent temperature and minimum accessible bed temperature in FB apparatuses. The heat-transfer agent temperature in real FB changes in the limits 150-1200°C, and bed temperature changes in the limits 95-350°C [4]. The bed temperature is the main factor, defining the final product moisture content, which practically doesn't depend on initial humidity, loading and unloading methods of dehydrated material.

The real process of constant and final material moisture content in the bed is caused by the high intensity of moisture removal at long estimation of main material mass in the bed.

The heat-transfer agent temperature changes in the limits from 1100° up to 100°C, the least layer temperature t_l-50°C, gas velocity in the bed changes in the limits from 0,1 up to 5m/s in the dependence on fineness of grain of material, heat loading Q changes from $1,3\cdot10^4$ up to $5,3\cdot10^6$ kkal/m^2·h in the possible dehydration conditions in FB apparatuses. The specific heat changes from ~30 kkal/kg up to ~3000 kkal/kg at initial humidity of feed stock from 2 up to 80%, i.e. at the change of initial humidity (W_H) from 0,03 up to 4 at final humidity (W_K), which is equal to zero, correspondingly. The specific capacity of FB apparatus on dry product can change from 4,6 up to $1,8\cdot10^5$ kg/m^2·h, correspondingly.

It is obvious, that average time of material estimation in the bed changes in wide limits from 7,7 up to 87h. For solutions τ_{av} is from 30 min up to 1h and more on calculation data.

The transitions by the type moistening – dehydration are reflected in the construction of granules, forming in the bed at solution fluidization, which present the nucleus with several membranes: rings on granule cuts show the number of "drying-moistening" cycles for the estimation time of particle in the bed.

It is obvious, that relation of quantity of dry hot and cool moist particles in the common case should increase with the increase of moisture quantity, evaporated in the bed.

Practically the bed height is chosen by experience from the stable apparatus work, uniform fluidization without channeling and balling of the bed point of view.

The particles of different sizes are in FB in real conditions, that's why there is definite region of gas velocities, corresponding to fluidized state of whole mass of these particles. The velocity of gas flow, corresponding to fluidized state, depends not only on particle sizes, but on their forms and densities. The gas velocity, corresponding to the beginning of bed transition into suspension state, so-called first critical velocity and gas velocity, corresponding to the beginning of entrainment of small particles from the bed, which is second critical velocity, present the most practical interest.

The conception about fluidization number K_W, which is equal the relation of operating rate of gas flow to the first critical velocity is often used for the characteristics of fluidized bed.

The optimal values K_W for each technological process vary in wide limits. The intensive mixture of solid particles in the bed takes place at value K_W=2. For very small particles (or for big viscosity of fluidizing agent) K_W=*80*, for large particles (or low viscosity of fluidizing agent) K_W=*8*.

It was mentioned above, that solution fluidization in FB apparatus is usually accompanied by formation of dry granular material. The granulation process consists of complicated complex of phenomena: growth because of deposition of dissolved substance on the surface, so-called normal growth, particle agglomeration, appearance of new ones because of granule crushing or at substance precipitation from the solution, agglomeration of fragments because of normal growth and etc.

It is considered, that realization of industrial process is based on the stabilization of bed granulometric composition and possibility of its regulation with taking under consideration the continuous solution introduction and material loading, i.e. the quantity of new centers should compensate the diminution of particles because on unloading at constant bed weight and composition. If there aren't enough the appearing new centers of granule formation for process stabilization, then they are introduced from outside in the form of small material.

For preliminary calculation let's take that mono-dispersion material with ball-shaped granules by diameter 1 mm will be obtained in FB apparatus. The formation velocity of fluidized bed, defined with the help of criterion equations, will be equal to 0.4184m/c. The entrainment velocity will be 5.5m/c.

The diameter of gas-distribution lattice is 270 mm. The quantity of holes is 330 by diameter 3 mm with countersinking below up to 6 mm. The square of gas-distributed lattice is equal 0.0572 m^2. The part of lattice flow section is 0.0408.

The heat quantity, given by one cubic meter of smoke fumes to fluidized bed is 21.51 kkal at decrease of gas temperature in the layer on 50°C. If we take under consideration the fact that approximately 600-700kkal is necessary for heating and evaporation of 1 kg salt solution, then necessary gas consumption will be 28-33m^3/kg. By orientation data [5] the electric energy consumption on 1kg of moisture, evaporated in FB apparatus is 0.11kVt·h for blow fan and 0.04kVt·h for draft fan.

The executive scheme of experimental-industrial installation is presented on the fig.1. The apparatuses with fluidized bed 1, blow fan 2, vessel for salt solution 3, compressor 4 are included in installation composition. FB apparatus is produced from still 3 by thickness 3 m in the form of welded tuncated cone with cutout 22°, the height of conical part of apparatus 3 m, and diameter of gas-distribution lattice 270m. The gas-distribution lattice 8 is produced from still 3 by thickness 20 mm. The diameter of holes in the lattice is 3 mm, below the lattice holes are countersunk ones by half of lattice thickness, the area of flow section is 5% from total area of gas-distributed lattice.

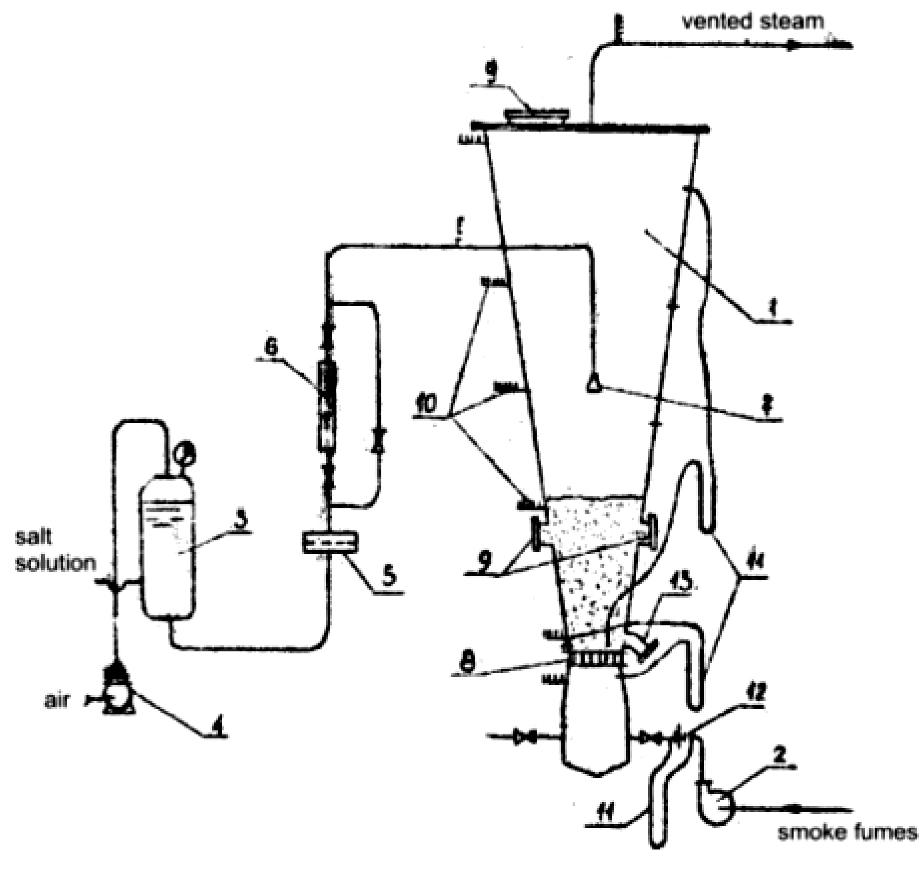

Fig. The technological scheme of experiment-industrial installation for dehydration of salt solution in FB apparatus with the use of heat of smoke fumes: 1 is FB apparatus; 2 is fan; 3 is concentrate (salt solution) capacity; 4 is compressor; 5 is filter; 6 is rotameter; 7 is burner; 8 is lattice; 9 are sight glasses; 10 are thermometers; 11 are manometers; 12 is Pitot tube; 13 is unloading of wastes (salts).

The smoke fumes are taken from boilers up to economizer and are pumped to FB apparatus by blow fan 2 at pressure 750 millimeter of mercury. The consumption of smoke fumes is measured with the help of Pitot tube12 and manometer.

The temperature of smoke fumes before economizer is equal to 160°C, thus, smoke fume is the fluidizing agent and heat-transfer agent simultaneously.

The production liquid wastes are put into capacity 3, whence are put into FB apparatus under pressure 1,5-3atm, created by air compressor 4. The concentrate in FB apparatus is sputtered under fluidized bend with the help of burner 7 of rugged scattering. The consumption of salt solution is measured by rotameter 6. The filter 5 is fixed for the prevention of burner clogging by corrosion products and different mechanical impurities on concentrate delivery line. The possibility of regulation of burner scattering and possibility of change of its position on the apparatus height are foreseen.

The liquid wastes (concentrates) in FB apparatus contact with hot bed particles, heat and evaporate. The evaporated moisture is taken from apparatus in the mixture with withdrawing smoke fumes. The dry product, forming in apparatus, is deduced from it through unloading 13.

The apparatus FB is equipped by sight glasses 9, thermometers 10 and manometers 11 for pressure measurements for control and regulation of the process.

It is proposed to use the technology on the heat power plants.

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AYRILAN QAZLARIN YÜKSƏKTEMPERATURLU ENERJİSİNDƏN İSTİFADƏ ETMƏKLƏ İSTEHSALIN MAYE TULLANTILARININ UTİLİZASİYASI

Ayrılan tüstü qazlarının yüksək temperaturlu enerjisindən istifadə etməklə istehsalın maye tullantılarının utilizasiya üçün texnologiya təklif olunur. Psevdomaye qatlı aparatın konstruksiya xüsusiyyətləri göstərilmişdir.Texnologiya istilik elektrik stansiyalarında istifadə oluna bilər.

А.Ф. Алиев

УТИЛИЗАЦИЯ ЖИДКИХ ОТХОДОВ ПРОИЗВОДСТВА С ИСПОЛЬЗОВАНИЕМ ВЫСОКОТЕМПЕРАТУРНОЙ ЭНЕРГИИ ОТВОДЯЩИХ ГАЗОВ

Предлагается технология утилизации жидких отходов производства с использованием высокотемпературной энергии отводящих дымовых газов. Приводятся конструктивные особенности аппарата с псевдоожижженным слоем. Технология может быть использована на тепловых электростанциях.

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