PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Method of Concentrating, Purifying and Separating the Disperse Phase of Colloidal Dispersions

We, "SEMPERIT" OSTERREICHISCH-AMERIKANISCHE GUMMIWERKE AKTIENGESELLSCHAFT, of 9—13, Helferstorferstrasse, Vienna 1, Germany, a German Company, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the concentration, purification and separation of the disperse phase of colloidal dispersions.

When a colloidal dispersion is subjected to electrophoresis between current-permeable diaphragms, the disperse phase migrates towards one of the diaphragms, where it accumulates. What happens to the phase accumulated at that diaphragm depends largely on the current and concentration conditions of the experiment, and the considerations which here come into question have been explained fully in our British Patent Specification No. 492,030, where they are discussed in reference to aqueous dispersions of rubber. Briefly, if the applied potential difference is high and the dispersion concentration is high, the disperse phase is deposited on the membrane in the form of a reversible paste, which will coagulate on drying, whilst if, on the other hand, both the applied potential difference and the colloid concentration are low, the disperse phase concentrates loosely, as it were, at the diaphragm and rises and/or falls there, spreading laterally throughout the cell liquid in the form of a layer or layers. Obviously between these extreme conditions, deposition and layering phenomena will both occur side by side, the one or the other preponderating according to the precise conditions, as explained in the patent specification referred to.

The present invention more particularly relates to a process of concentrating, purifying and separating the disperse phase of colloidal dispersions of the kind referred to in which the conditions maintained ensure the ascent and/or descent of accumulated disperse phase at one of the diaphragms. In the previous processes of this kind the concentrated disperse phase ascending and/or descending at the diaphragm has been allowed to spread laterally in layerwise fashion in the cell liquid, and has been removed by drawing off the layer or layers. Continuous working with such layer formation has been described in the specification of our British Patent Application No. 505,753.

During the period of its layerwise spread throughout the liquid of the cell the concentrated disperse phase is subjected to the action of the electric current, whereby its properties may be changed somewhat. This is referred to in the specification of our British Patent Application No. 505,753. It is frequently desirable, however, to avoid this subjection of the concentrated disperse phase to the influence of the current as far as possible, so that the said phase can be obtained without any further change in its state, such as coagulation or loss of stability, and no unnecessary current consumption occurs. In order to do this it is necessary to remove the disperse phase rapidly from the electric field immediately after its concentration, and accordingly the process provided by the present invention for concentrating, purifying and separating the disperse phase of colloidal dispersions consists in applying a potential difference to the dispersion between diaphragms whereby the particles of the disperse phase are caused to migrate towards, and to accumulate at, one of said diaphragms to rise and/or to fall there according to the density thereof with respect to the surrounding liquid, and guiding said rising and/or falling phase directly from said diaphragm surface out of the electric field.

The process provided by the invention may be carried out by providing containers both on top and underneath the cell into which the separating disperse phase, and maybe dispersing phase, is guided as it rises and/or falls at the diaphragm surface, and from which the collecting phases can be withdrawn as

required. The separating colloid is thus rapidly removed from the influence of the electric field immediately after concentration, with the result that any further change in the state of the colloid itself, such as coagulation or loss of stability, is inhibited, and no unnecessary consumption of electric current takes place. The apertures connecting said containers with the cell vessel may with advantage be made of such small cross-section that no appreciable portion of the current is diverted by the formation of current loops.

The accompanying drawing shows in partial section by way of example one form of cell suitable for carrying out the process of the invention and having receiving vessels communicating with the cell above and below the same.

In the drawing, A is an inner cell, while N_1 and N_2 are the water-filled outer cells in which the electrodes H_1 and H_2, which are connected to the current source, are placed. M_1 and M_2 denote the diaphragms. At the lower end of the cell A a container B is provided adapted to be closed at the top and at the bottom by means of stop-cocks C_1 and C_2 respectively. D represents a vent cock. Above the vessel A and communicating therewith is the container E having an outflow F. Centrally in this latter vessel there is provided a tube G the upwardly bent lower end of which extends into the vessel A. This tube communicates with a storage vessel containing the starting colloidal dispersion. The tube G should preferably terminate near the top of the cell space, as shown in the accompanying drawing, in the case of a starting dispersion which will sink in the cell liquid, and near the bottom of the cell space in the case of a dispersion which will rise in the cell liquid. Either type of dispersion may be supplied if the tube G terminates at about the middle of the cell space.

The concentrated colloidal layer forming at the diaphragm sinks, e.g. in the case of negative colloids along the anodic diaphragm M_2 in the direction indicated by the arrows to the bottom of the vessel A, provided the specific gravity is higher than that of the colloidal dispersion used, as occurs for example in the case of a gold sol. This layer then flows on into the vessel B. The aqueous phase rising at the cathodic diaphragm M_1 at the same time ascends into the container E and flows off through the outlet F, while the starting colloidal dispersion is admitted through the tube G. The rate at which the aqueous phase flows off depends upon the rate of admission of the colloidal dispersion through the tube G. The rate of feed or admission is best regulated in such a manner that no colloid-free layer or only a very slight colloid-free layer is allowed to collect in the middle cell.

When the container B has become filled with the separated and highly concentrated layer the pure and highly concentrated colloid obtained may be drawn off by closing the stop-cock C_1 and opening the stop-cock C_2 and the vent D. The described cycle may be repeated any number of times.

Since both the colloid and also the aqueous phase are conducted away immediately after separation, while the starting colloidal liquid is constantly admitted, it follows that in this process the cell is always filled with this liquid. The electric current used is therefore utilised to the best advantage, and may be employed at high voltages owing to the shortness of the time for which the current is caused to act upon the concentrated colloid. It is further advantageous to provide a plurality of diaphragms side by side in the cell, or to arrange a plurality of cells having common collecting vessels at the top and bottom, and thus to obtain a multiplication of the effect.

The method according to the present invention proves particularly advantageous in the handling of colloidal solutions of highly dilute disperse phase and high electrolyte concentration, which are difficult to concentrate owing to the injurious effect of such high concentration of electrolyte. Colloidal solutions of this description, which are produced for example when electrolytes capable of interacting with production of an insoluble product are caused to interact under conditions ensuring the separation of that product in a colloidal state, can only be prepared in a stable condition at a high degree of dilution. The method according to the present invention allows colloidal liquids of this description, which are very difficult of concentration in any other manner, to be concentrated in an extremely simple and convenient manner without any deleterious effect upon the colloid.

The method provided by this invention may be applied to colloidal dispersions of all kinds and it is to be distinctly understood that the invention is not limited in this respect. As examples of dispersions to which it is particularly applicable, however, may be mentioned aqueous dispersions of rubber. Such dispersions may for example comprise those consisting of or containing rubber, gutta percha,

balata or similar vegetable resins occurring naturally or artificially obtained, and in a vulcanised or unvulcanised condition. Aqueous dispersions of coagulated rubber, vulcanised rubber, synthetic rubber waste or reclaim may also be used if desired as alternatives or admixtures. Any of the aforesaid dispersions may contain the usual known compounding ingredients.

In applying the process of this invention to rubber dispersions of the kinds described above the fresh dispersions may be continuously admitted through the tube G, which is preferably extended downwards so that the fresh dispersion enters the lower part of the vessel A. The stop-cocks C_1 and C_2 are preferably kept open, the concentrate rising into the container E whence the overflowing of concentrate passes through the pipe F for storage or distribution in any suitable manner, while the serum is evacuated through C_2.

In the case of aqueous dispersions of polymerised vinylchlorethylene also known as Neoprene, the concentrated disperse phase falls as in the case of gold sols, and consequently the inlet tube G may be used as shown in the drawing without being extended downwardly to the bottom of the cell.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A process for concentrating, purifying and separating the disperse phase of colloidal dispersions consisting in applying a potential difference to the dispersion between diaphragms whereby the particles of the disperse phase are caused to migrate towards, and to accumulate at, one of said diaphragms to rise and/or to fall there according to the density thereof with respect to the surrounding liquid, and guiding said rising and/or falling phase directly from said diaphragm surface out of the electric field.

2. A process as claimed in claim 1 in which the rising and/or falling disperse phase is conducted to a receiving vessel communicating with the space between the membranes.

3. A process as claimed in claim 1 or 2 in which fresh colloidal dispersion is continuously fed into the space between the electrodes, dispersion medium separated from the disperse phase at the same time being continuously withdrawn therefrom.

4. An apparatus for carrying out the process claimed in any one of the preceding claims comprising a cell having two electrodes separated from one another by a pair of diaphragms and receiving vessels in communication with the top and bottom respectively of the inter-diaphragm space.

5. The improved process for concentrating, purifying and separating the disperse phase of colloidal dispersions substantially as hereinbefore described.

6. The improved apparatus for carrying out the process claimed in claim 5 substantially as hereinbefore described.

7. Disperse phase concentrated, purified and separated by the process hereinbefore described and claimed.

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