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(54) Treatment of oil effluent

(57) A method of splitting a soluble oil effluent, in which the effluent is applied to a coarse separator and then mixed in successive stages with a polyelectrolyte and a coagulant, the resultant flocculated oil/water phase then being treated in a dissolved air flotation unit whereby to separate and recover the oil and water fractions. A coagulating tank may be provided immediately downstream of the mixer stages for the mixture to swell for a period and a clarifier tank may follow the coagulating tank, again to provide a dwell period for the separating mixture, the floating oil being recovered so as to provide a cleaner/clearer mixture for the dissolved air flotation unit.

The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.
The claims were filed later than the filing date with the period prescribed by Rules 25(1) of the Patents Rules 1982.

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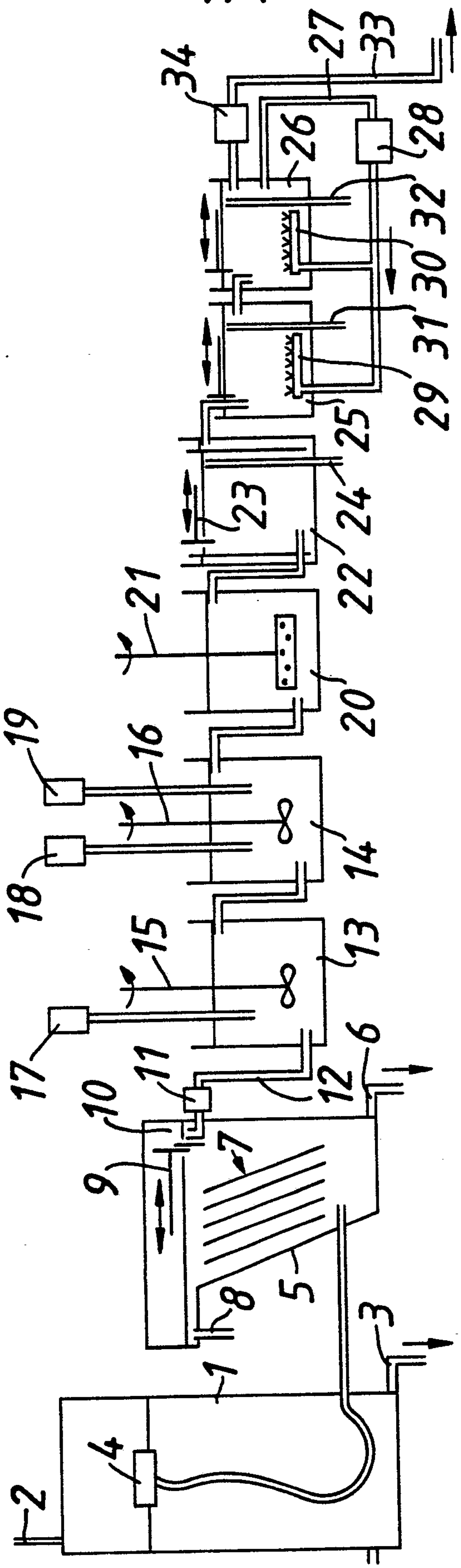
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TREATMENT OF OIL EFFLUENT

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This invention relates to the treatment of oil effluent, in particular the splitting or separation of waste soluble oil arising from an industrial process such as to produce an acceptably oil-free water for ready discharge into water courses.

Hitherto, one method for disposing of a waste oil emulsion from industrial sites has involved acid "cracking" involving heating the emulsion and treating with sulphuric or hydrochloric acids. This method is costly to run, however, because of the requirement to heat the emulsion and the need to purchase the acid. Further, the oil and aqueous sidestreams produced are extremely acidic which thus need to be neutralised, involving more cost.

It is an object of this invention to provide an improved treatment method.

From one aspect, the present invention consists in a method of splitting a soluble oil effluent, in which the effluent is applied to a coarse separator and then mixed in successive stages with a polyelectrolyte and a coagulant, the resultant flocculated oil/water phase then being treated in a dissolved air flotation unit whereby to separate and recover the oil and water fractions.

Although this invention is designed to operate at ambient temperatures, the tanks for the mixer stages may be heated such that the reaction takes place at, say, between 22°C and 27°C.

A coagulating tank may be provided immediately downstream of the mixer stages for the mixture to dwell for a period; a slow stirring motion may be imparted to the contents here. A static clarifier tank may follow the coagulating tank, again to provide a dwell period for the separating mixture, the floating oil being recovered so as to provide a cleaner/clearer mixture for the dissolved air flotation unit.

Preferably, the coarse separator is a tilted plate (corrugated) separator.

Oil concentrations of 0.1% to 25% in the effluent may readily by treated in accordance with this invention from which substantially oil free water (oil level of the order of 0.01%) may be obtained. With further processing, "polishing", this may be reduced again eg. to 0.003%.

The chemical oxygen demand on the water course with this much cleansed effluent is reduced by a significant factor ($\sim$8) compared with practice hitherto.

The polyelectrolyte is a low molecular weight cationic polymer the function of which is to coalesce the very finely divided oil droplets in the effluent into larger agglomerates in which form they separate easily from the main aqueous phase.

The coagulant (flocculant) is a higher molecular weight liquid anionic polymer which enhances the action of the cationic polyelectrolyte by allowing the aforementioned aggolmerates to grow, thus facilitating their even faster removal from the aqueous phase.

In order that the invention may be fully understood, one embodiment thereof will now be described, by way of example, with reference to the accompanying drawing which schematically illustrates apparatus for performing this method.

In particular, oil effluent from say, an electrical strip steel treatment mill, eg. waste oil emulsion together with insoluble tramp oil such as lubricating oil, is collected in an insulated holding tank which is vented at 2 and has an outlet port 3 for sedimentary sludge, grit etc. A pump 4 floats on the surface of the effluent, so as to be well clear of the sludge and to maintain an appreciable oil concentration, and pumps the effluent to a tilted plate separator 5. As with the tank 1, this separator has a sludge port 6 but its principal component is a series of inclined closely spaced corrugated plates 7. The insoluble (black) oil content is 'intercepted' by the underside of these plates which particles (say >85 microns) flow to the peaks of the corrugations and are released at the top as larger droplets which float on the surface and are removed via a drain 8 on being scraped towards same by a reciprocable scraper 9. The "clean" oil emulsion collects in a shielded area 10 and this emulsion is gravity fed through an oil-monitoring unit 11 via pipework 12 to the first of two chemical dosing tanks 13, 14 having high speed stirrers 15,16 respectively.

A polyelectrolyte blended with water for the concentration required is introduced into tank 13 by a dosing pump 17 and the mixed content flows to the adjoining tank 14 at which a further dose of the polyelectrolyte/water solution is introduced for trimming via pump 18; additionally, a coagulant, likewise blended with water is introduced here by pump 19 - this may be of the peristaltic type.

The liquid mixture flows under gravity from the tank 14 to dwell in a tank 20 which has a very slow speed stirrer 21 to promote coagulation and flocculation of the separated oil. From here the liquid flows to a static clarifier tank 22 to allow a further period for flocculation, a reciprocable scraper 23 being sited here to drain off the collected oil fraction via 24.

The clearer liquid which collects around the periphery of this tank is taken off into the first of two dissolved air flotation units 25, 26 which are serially coupled. These speed up the separation of the oil floccs from the mixture entering and operate by recycling a proportion, about 10%, of the 'clean' water trapped off at 27 and dissolving air in this under pressure in a compressor unit 28, this aerated fluid then being injected through nozzles 29, 30. The microbubbles issuing from these nozzles attach themselves to the oil floccs and float them to the surface thus clarifying the effluent; the oil 'mousse' formed on the surface - typically 10% oil and 45% each of water and air - is periodically scraped off to drains 31, 32. The clean water output from the second of the d.a.f's (26) is passed to a final discharge drain 33 via a monitor 34.

In particular, this monitor and that at 11 are utilised to govern the dose rate of the chemicals into the tanks 13, 14; without this matching under-dosing will not fully destabilise the emulsion whilst over-dosing will re-stabilise it.

By using as the polyelectrolyte the cationic polymer EM 470 FP (based on a copolymer of Acrylamide and a quarternised cationic monomer; molecular wt about 2×10^6) prepared as an emulsion - 48% active content - and as the coagulant a liquid anionic polymer EA 300 (based on a copolymer of

Acrylamide and Sodium Acrylate; molecular wt about 13 x 10^6; 0.1% active) the water discharged at 33 may readily have an oil level as low as about 0.01%. Flow rates of the order of 8 cubic metres per hour have been successfully treated.

Although the invention has been described with reference to the particular embodiment illustrated it is to be understood that various modifications may readily be made without departing from the scope of the invention. For example, further delay tanks or coils may be introduced to aid separation and clarification and, as mentioned, heaters may be introduced into the dosing tanks to aid the reaction. Further other polyelectrolytes and coagulants than those specifically noted above may equally well be used.

We claim:-

1. A method of splitting a soluble oil effluent, in which the effluent is applied to a coarse separator and then mixed in successive stages with a polyelectrolyte and a coagulant, the resultant flocculated oil/water phase then being treated in a dissolved air flotation unit whereby to separate and recover the oil and water fractions.

2. A method according to claim 1 in which the mixing stages are effected in tanks equipped with heaters.

3. A method according to claim 1 or claim 2, in which storage tanks are provided for the coagulated mixture, whereby to permit dwell periods for said mixture and the separating (floating) oil to be removed prior to treatment of the residue in the dissolved air flotation unit.

4. A method according to any one of claims 1 to 3, in which aerated water is injected into the flotation unit through a plurality of nozzles whereby to produce a rising cloud of microbubbles effective to float the oil floccs to the surface to form thereon an oil mousse for removal.

5. A method according to any one of claims 1 to 4, in which a cleanliness monitor is provided at the water outlet from the dissolved air flotation unit whereby to govern the dosage rate of the polyelectrolyte and coagulant.

6. A method according to any one of claims 1 to 5, in which the polyelectrolyte is a catonic polymer based on a copolymer of acrylamide and a quarternised cationic monomer.

7. A method according to any one of claims 1 to 6, in which the coagulant is an anionic polymer, based on a copolymer of acrylamide and sodium acrylate, in liquid or powdered form.

8. A method according to any one of claims 1 to 7, in which the coarse separator embodies a series of tilted corrugated plates against the underside of which the coarse oil components collect, rising to the surface for removal.

9. A method of splitting a soluble oil effluent, substantially as herein described and illustrated in the accompanying drawing.

10. Apparatus for performing a method according to any one of claims 1 to 9.

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