CLAIMS

1. A method for recovering potassium iodide and boric acid from an iodine-containing waste water produced by PVA dyeing, characterized by comprising the steps of:

(1) adjusting a pH value of the iodine-containing waste water to be within a range of 3 to 12 with potassium hydroxide to obtain a solution A;

(2) adding a reducing agent to the solution A obtained in step (1) to reduce I_2 to I^-, stirring the solution A until I_2 is completely reduced to I^- so as to obtain a solution B;

(3) separating the solution B obtained in step (2) into a concentrated water C having a concentration of potassium iodide more than 0.1%, preferably 0.1% to 10%, and a fresh water D having a concentration of potassium iodide of 0% to 0.01% by a membrane module;

(4) concentrating the concentrated water C obtained in step (3) by an evaporator to obtain a concentrated solution E having a specific gravity of 1.1 to 1.6 and a condensate water collected from the evaporator is reused, wherein the condensate water is, preferably mixed with raw water, used for production so as to save raw water consumption;

(5) analyzing concentration of potassium borate in the concentrated solution E obtained in step (4) and selecting one of the following operating steps according to the obtained concentration of potassium borate, wherein, the said threshold concentration is 80 g/L to 160 g/L:

(A) if the concentration of potassium borate is lower than a threshold concentration, centrifuging the concentrated solution E from step (4) at a temperature of 40°C to

60°C to obtain potassium iodide product and returning residue to mix with the concentrated water C in step (4);

(B) if the concentration of potassium borate is equal to the threshold concentration, centrifuging the concentrate solution E obtained from step (4) at a temperature of 25°C to 35°C to obtain potassium iodide product and a residue solution F, cooling the residue solution F to a temperature of 10°C to 25°C and adding hydrogen iodide acid to adjust the pH value to be within a range of 1 to 4 and centrifuging the residue solution F to obtain boric acid product, and returning residue to mix with the concentrated water C in step (4);

(C) if the concentration of potassium borate is higher than the threshold concentration, adding water to the concentrate solution E until the concentration of potassium borate equals to the threshold concentration and returning to step (B);

(6) contacting the fresh water D obtained from step (3) to an ion exchange resin to obtain a resin enriched in potassium iodide and potassium borate, returning residual directly or mixed with raw water to production so as to save raw water consumption;

(7) eluting the enriched resin obtained in step (6) to obtain an eluate G containing both potassium iodide and potassium borate in a concentration range of 1% to 5% and recycling the eluted resin;

(8) returning the eluent G obtained in step (7) to step (4) to be mixed with the concentrated water C for preparation of the concentrated solution E.

2. A method for recovering potassium iodide and boric acid from an iodine-containing waste water produced by PVA dyeing according to claim 1, characterized in that, in the step (1), the final pH value of the iodine-containing waste water adjusted by potassium hydroxide is in a range from 6 to 11.

3. A method for recovering potassium iodide and boric acid from an iodine-containing waste water produced by PVA dyeing according to claim 1, characterized in that, in the step (2), said reducing agent comprises an organic reducing agent and an inorganic reducing agent, wherein the said inorganic reducing agent comprises one or more selected from a group consisting of formic acid, potassium borohydride, hydrogen gas and potassium sulfite.

4. A method for recovering potassium iodide and boric acid from an iodine-containing waste water produced by PVA dyeing according to claim 1, characterized in that, in the step (3), the said membrane module comprises at least one or more functional unit selected from a group consisting of coarse filtration, reverse osmosis, nanofiltration, ultrafiltration and an ion-exchange membrane.

5. A method for recovering potassium iodide and boric acid from an iodine-containing waste water produced by PVA dyeing according to claim 1, characterized in that, in the step (4), the said evaporator is operated under a reduced pressure in a vacuum degree of 0.01 MPa to 0.09 Mpa, or the said evaporator is at least one or more selected from a group consists of mechanical vapor recompression, single-effect equipment and multiple effect equipment, or the material for the said evaporator ~~material~~ contains at least one or more selected from the groups of enamel, stainless steel and titanium alloyed composite materials.

6. A method for recovering potassium iodide and boric acid from an iodine-containing waste water produced by PVA dyeing according to claim 1, characterized in that, in the step (5)(A), the potassium iodide product is obtained from centrifugal separation when concentration of potassium borate in the concentrated solution E is lower than the said threshold concentration, preferably, the said threshold concentration is 120 g/L.

7. A method for recovering potassium iodide and boric acid from an iodine-

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1. A method for recovering potassium iodide and boric acid from an iodine-containing waste water produced by PVA dyeing, characterized by comprising the steps of:

(1) adjusting a pH value of the iodine-containing waste water to be within a range of 3 to 12 with potassium hydroxide to obtain a solution A;

(2) adding a reducing agent to the solution A obtained in step (1) to reduce I_2 to I^-, stirring the solution A until I_2 is completely reduced to I^- so as to obtain a solution B;

(3) separating the solution B obtained in step (2) into a concentrated water C having a concentration of potassium iodide more than 0.1%, preferably 0.1% to 10%, and a fresh water D having a concentration of potassium iodide of 0% to 0.01% by a membrane module;

(4) concentrating the concentrated water C obtained in step (3) by an evaporator to obtain a concentrated solution E having a specific gravity of 1.1 to 1.6 and a condensate water collected from the evaporator is reused, wherein the condensate water is, preferably mixed with raw water, used for production so as to save raw water consumption;

(5) analyzing concentration of potassium borate in the concentrated solution E obtained in step (4) and selecting one of the following operating steps according to the obtained concentration of potassium borate, wherein, the said threshold concentration is 80 g/L to 160 g/L:

(A) if the concentration of potassium borate is lower than a threshold concentration, centrifuging the concentrated solution E from step (4) at a temperature of 40°C to

60°C to obtain potassium iodide product and returning residue to mix with the concentrated water C in step (4);

(B) if the concentration of potassium borate is equal to the threshold concentration, centrifuging the concentrate solution E obtained from step (4) at a temperature of 25°C to 35°C to obtain potassium iodide product and a residue solution F, cooling the residue solution F to a temperature of 10°C to 25°C and adding hydrogen iodide acid to adjust the pH value to be within a range of 1 to 4 and centrifuging the residue solution F to obtain boric acid product, and returning residue to mix with the concentrated water C in step (4);

(C) if the concentration of potassium borate is higher than the threshold concentration, adding water to the concentrate solution E until the concentration of potassium borate equals to the threshold concentration and returning to step (B);(6) contacting the fresh water D obtained from step (3) to an ion exchange resin to obtain a resin enriched in potassium iodide and potassium borate, returning residual directly or mixed with raw water to production so as to save raw water consumption;

(7) eluting the enriched resin obtained in step (6) to obtain an eluate G containing both potassium iodide and potassium borate in a concentration range of 1% to 5% and recycling the eluted resin;

(8) returning the eluent G obtained in step (7) to step (4) to be mixed with the concentrated water C for preparation of the concentrated solution E.

2. A method for recovering potassium iodide and boric acid from an iodine-containing waste water produced by PVA dyeing according to claim 1, characterized in that, in the step (1), the final pH value of the iodine-containing waste water adjusted by potassium hydroxide is in a range from 6 to 11.

3. A method for recovering potassium iodide and boric acid from an iodine-containing waste water produced by PVA dyeing according to claim 1, characterized in that, in the step (2), said reducing agent comprises an organic reducing agent and an inorganic reducing agent, wherein the said inorganic reducing agent comprises one or more selected from a group consisting of formic acid, potassium borohydride, hydrogen gas and potassium sulfite.

4. A method for recovering potassium iodide and boric acid from an iodine-containing waste water produced by PVA dyeing according to claim 1, characterized in that, in the step (3), the said membrane module comprises at least one or more functional unit selected from a group consisting of coarse filtration, reverse osmosis, nanofiltration, ultrafiltration and an ion-exchange membrane.

5. A method for recovering potassium iodide and boric acid from an iodine-containing waste water produced by PVA dyeing according to claim 1, characterized in that, in the step (4), the said evaporator is operated under a reduced pressure in a vacuum degree of 0.01 MPa to 0.09 Mpa, or the said evaporator is at least one or more selected from a group consists of mechanical vapor recompression, single-effect equipment and multiple effect equipment, or the material for the said evaporator contains at least one or more selected from the groups of enamel, stainless steel and titanium alloyed composite materials.

6. A method for recovering potassium iodide and boric acid from an iodine-containing waste water produced by PVA dyeing according to claim 1, characterized in that, in the step (5)(A), the potassium iodide product is obtained from centrifugal separation when concentration of potassium borate in the concentrated solution E is lower than the said threshold concentration, preferably, the said threshold concentration is 120 g/L.

7. A method for recovering potassium iodide and boric acid from an iodine-