Claims

[Claim 1]

A desalting process for a chlorine-containing powder, comprising

a slurry formation step of forming slurry by blending a first desalting washing-solution with a chlorine-containing powder,

a chlorine elution step of eluting chlorine contained in the chlorine-containing powder into a liquid phase within the slurry,

a desalted cake formation step of separating part or whole of the liquid phase from the slurry, from which chlorine has been eluted, to obtain a first desalted cake and a first filtrate, and

a desalted cake washing step of washing the first desalted cake with a second desalting washing-solution, which is different from the first desalting washing-solution, to obtain a second desalted cake and a second filtrate, wherein

while the first filtrate obtained in the desalted cake formation step and/or the second filtrate obtained in the desalted cake washing step are at least partly recycled as the first desalting washing-solution and a chlorine ion concentration of the first desalting washing-solution is controlled as such that, in a case where the chlorine ion concentration of the first desalting washing-solution exceeds a first threshold, the first desalting washing-solution is controlled so as to satisfy the first threshold, with a fresh first desalting washing-solution, the slurry formation step, the chlorine elution step, the desalted cake formation step and the desalted cake washing step are repeated every time a chlorine-containing powder is supplied.

[Claim 2]

The desalting process for a chlorine-containing powder according to Claim 1, wherein sea water is used as the first desalting washing-solution to be initially added to the chlorine-containing powder, and the chlorine ion concentration of the first desalting washing-solution is controlled not to exceed 15 mass%.

[Claim 3]

The desalting process for a chlorine-containing powder according to Claim 1, wherein, while the second filtrate obtained in the desalted cake washing step is at least partly recycled as the second desalting washing-solution and a chlorine ion concentration of the second desalting washing-solution is controlled, the slurry formation step, the

chlorine elution step, the desalted cake formation step and the desalted cake washing step are repeated every time a chlorine-containing powder is supplied.

[Claim 4]

The desalting process for a chlorine-containing powder according to Claim 3, wherein, in a case where the chlorine ion concentration of the second desalting washing-solution exceeds a second threshold, which is different from the first threshold, the second desalting washing-solution is controlled so as to satisfy the second threshold, with a fresh second desalting washing-solution.

[Claim 5]

The desalting process for a chlorine-containing powder according to Claim 3 or 4, wherein the chlorine ion concentration of the second desalting washing-solution is controlled so as not to exceed 3.5 mass%.

[Claim 6]

The desalting process for a chlorine-containing powder according to Claim 1, further comprising the following steps (1) to (3):

(1) a drainage collection step of collecting one or two or more of washing solutions selected from the group consisting of the first filtrate, the second filtrate, the first desalting washing-solution recycled as the first desalting washing-solution and the second desalting washing-solution recycled as the second desalting washing-solution and not be subjected to recycling as the first desalting washing-solution or the second desalting washing-solution, as drainage;

(2) a heavy metal insolubilization step of insolubilizing heavy metals contained in the drainage as a flocculate like floc by adding a heavy metal scavenger to the drainage collected in the step (1);

(3) a heavy metal flocculation cake formation step of separating part or whole of a liquid phase from a flocculation (floc)-containing solution containing heavy metals insolubilized in the step (2) to obtain a first flocculation cake and a third filtrate.

[Claim 7]

The desalting process for a chlorine-containing powder according to Claim 6, further comprising the following step (4):

(4) a heavy-metal flocculation cake washing step of washing the first flocculation cake with a third desalting washing-solution, which is different from the first desalting

washing-solution and the second desalting washing-solution, to obtain a second flocculation cake and a fourth filtrate.

[Claim 8]

The desalting process for a chlorine-containing powder according to Claim 6 or 7, wherein, in the heavy metal insolubilization step, a pH of the drainage is set to 7 to 11.

[Claim 9]

The desalting process for a chlorine-containing powder according to Claim 7, wherein the fourth filtrate obtained in the heavy metal flocculation cake washing step is at least partly recycled as the first desalting washing-solution.

[Claim 10]

The desalting process for a chlorine-containing powder according to Claim 9, wherein, while the second filtrate obtained in the desalted cake washing step is at least partly used as the third desalting washing-solution and/or the fourth filtrate obtained in the heavy metal flocculation cake washing step is at least partly recycled as the third desalting washing-solution, and a chlorine ion concentration of the third desalting washing-solution is controlled, the washing treatment in the heavy metal flocculation cake washing step is carried out.

[Claim 11]

The desalting process for a chlorine-containing powder according to Claim 10, wherein in a case where the chlorine ion concentration of the third desalting washing-solution exceeds a third threshold, which is different from the first threshold and the second threshold, the third desalting washing-solution is controlled so as to satisfy the third threshold with a fresh third desalting washing-solution.

[Claim 12]

The desalting process for a chlorine-containing powder according to Claim 10, wherein the chlorine ion concentration of the third desalting washing-solution is controlled so as not to exceed 3.5 mass%.

[Claim 13]

The desalting process for a chlorine-containing powder according to Claim 1 or 6, wherein the chlorine-containing powder includes one or two or more powders selected from incineration fly ash, flue ash and chlorine bypass dust.

[Claim 14]

A desalter for a chlorine-containing powder comprising

a first desalting washing-solution supply apparatus for supplying a first desalting washing-solution,

an elution vessel for forming slurry by blending a chlorine-containing powder with the first desalting washing-solution from the first desalting washing-solution supply apparatus; and at the same time, eluting chlorine contained in the chlorine-containing powder into a liquid phase within the slurry,

a first solid-liquid separation apparatus for separating part or whole of the liquid phase from the slurry from which the chlorine is removed by elution to obtain a first desalted cake and a first filtrate,

a slurry carrier device, which transports the slurry treated in the elution vessel to the first solid-liquid separation apparatus,

a second desalting washing-solution supply apparatus for supplying a second desalting washing-solution, which is different from the first desalting washing-solution, for washing the first desalted cake in the first solid-liquid separation apparatus to obtain a second desalted cake and a second filtrate,

a first solution-sending apparatus for sending the first filtrate obtained in the first desalted cake formation treatment performed in the first solid-liquid separation apparatus and/or the second filtrate obtained in the first desalted cake washing treatment performed in the first solid-liquid separation apparatus to the first desalting washing-solution supply apparatus in order to recycle at least parts of the first filtrate and/or the second filtrate as the first desalting washing-solution,

a first chlorine ion concentration monitoring apparatus for monitoring the chlorine ion concentration of the first desalting washing-solution, and

a fresh first desalting washing-solution supply apparatus for supplying a fresh first desalting washing-solution as the first desalting washing-solution to the first desalting washing-solution supply apparatus, wherein

the first desalting washing-solution supply apparatus comprises a first supply regulation valve, which can change the amount of the first desalting washing-solution to be supplied from the first desalting washing-solution supply apparatus to the elution vessel; and at the same time, which enables discharge from the first desalting washing-solution supply apparatus,

the fresh first desalting washing-solution supply apparatus comprises a second supply regulation valve, which can change the amount of the washing solution to be

supplied to the first desalting washing-solution supply apparatus, and

in a case where the chlorine ion concentration of the first desalting washing-solution exceeds a first threshold, the first supply regulation valve is controlled to stop or reduce supply of the first desalting washing-solution from the first desalting washing-solution supply apparatus to the elution vessel, and to discharge part or whole of the first desalting washing-solution from the first desalting washing-solution supply apparatus, and then, the second supply regulation valve of the fresh first desalting washing-solution supply apparatus is controlled to supply the fresh first desalting washing-solution to the first desalting washing-solution supply apparatus as the first desalting washing-solution so as to satisfy the first threshold.

[Claim 15]

The desalter for a chlorine-containing powder according to Claim 15, further comprising

a second solution-sending apparatus for sending the second filtrate obtained in the first desalted cake washing treatment performed in the first solid-liquid separation apparatus to the second desalting washing-solution supply apparatus in order to recycle at least part of the second filtrate as the second desalting washing-solution; and

a second chlorine ion concentration monitoring apparatus for monitoring the chlorine ion concentration of the second desalting washing-solution.

[Claim 16]

The desalter for a chlorine-containing powder according to Claim 15, further comprising

a fresh second desalting washing-solution supply apparatus for supplying a fresh second desalting washing-solution as the second desalting washing-solution to the second desalting washing-solution supply apparatus, wherein

the second desalting washing-solution supply apparatus comprises a third supply regulation valve, which can change the amount of the second desalting washing-solution to be supplied from the second desalting washing-solution supply apparatus to the first desalted cake; and at the same time, which enables discharge from the second desalting washing-solution supply apparatus;

the fresh second desalting washing-solution supply apparatus comprises a fourth supply regulation valve, which can change the amount of the washing solution to be supplied to the second desalting washing-solution supply apparatus; and

in a case where the chlorine ion concentration of the second desalting washing-solution exceeds a second threshold, which is different from the first threshold, the third supply regulation valve is controlled to stop or reduce supply of the second desalting washing-solution from the second desalting washing-solution supply apparatus to the first desalted cake, and to discharge part or whole of the second desalting washing-solution from the second desalting washing-solution supply apparatus, and then, the fourth supply regulation valve of the fresh second desalting washing-solution supply apparatus is controlled to supply the fresh second desalting washing-solution to the second desalting washing-solution supply apparatus, as the second desalting washing-solution so as to satisfy the second threshold.

[Claim 17]

The desalter for a chlorine-containing powder according to Claim 14 or 15, further comprising

a heavy metal insolubilization reaction vessel for collecting and storing one or two or more solutions selected from the group consisting of the first filtrate and the second filtrate that are not to be recycled as the first desalting washing-solution or the second desalting washing-solution, the first desalting washing-solution sent as drainage from the first desalting washing-solution supply apparatus, and the second desalting washing-solution sent as drainage from the second desalting washing-solution supply apparatus, and insolubilizing heavy metals contained in the drainage as a flocculate like floc by adding a heavy metal scavenger thereto;

a second solid-liquid separation apparatus, which separates part or whole of the liquid phase from the flocculation (floc)-containing solution containing the insolubilized heavy metals to obtain a first flocculation cake and a third filtrate; and

a flocculation (floc)-containing solution carrier device for transporting the flocculation (floc)-containing solution treated in the heavy metal insolubilization reaction vessel to the second solid-liquid separation apparatus.

[Claim 18]

The desalter for a chlorine-containing powder according to Claim 17, further comprising

a third desalting washing-solution supply apparatus for supplying a third desalting washing-solution, which is different from the first desalting washing-solution and the second desalting washing-solution, for washing in the second solid-liquid separation

apparatus to obtain a second flocculation cake and a fourth filtrate.

[Claim 19]

The desalter for a chlorine-containing powder according to Claim 17, further comprising

a third solution-sending apparatus for sending the fourth filtrate obtained in washing treatment of the first flocculation cake performed in the second solid-liquid separation apparatus, to the first desalting washing-solution supply apparatus in order to recycle at least part of the fourth filtrate as the first desalting washing-solution.

[Claim 20]

The desalter for a chlorine-containing powder according to Claim 17, further comprising

a fourth solution-sending apparatus for sending the second filtrate obtained in the first desalted cake washing treatment performed in the first solid-liquid separation apparatus, to the third desalting washing-solution supply apparatus in order to use at least part of the second filtrate as the third desalting washing-solution, and/or,

a fifth solution-sending apparatus for sending the fourth filtrate obtained in the first flocculation cake washing treatment performed in the second solid-liquid separation apparatus, to the third desalting washing-solution supply apparatus in order to recycle at least part of the fourth filtrate as the third desalting washing-solution, and

a third chlorine ion concentration monitoring apparatus for monitoring a chlorine ion concentration of the third desalting washing-solution.

[Claim 21]

The desalter for a chlorine-containing powder according to Claim 20, further comprising

a fresh third desalting washing-solution supply apparatus for supplying a fresh third desalting washing-solution as the third desalting washing-solution to the third desalting washing-solution supply apparatus, wherein

the third desalting washing-solution supply apparatus comprises a fifth supply regulation valve, which can change the amount of the third desalting washing-solution to be supplied from the third desalting washing-solution supply apparatus to the first flocculation cake; and at the same time, which enables discharge from the third desalting washing-solution supply apparatus;

the fresh third desalting washing-solution supply apparatus comprises a sixth

supply regulation valve, which can change the amount of the washing solution to be supplied to the third desalting washing-solution supply apparatus; and

in a case where the chlorine ion concentration of the third desalting washing-solution exceeds a third threshold, which is different from the first threshold and the second threshold, the fifth supply regulation valve is controlled to stop or reduce supply of the third desalting washing-solution from the third desalting washing-solution supply apparatus to the first flocculation cake, and to discharge part or whole of the third desalting washing-solution from the third desalting washing-solution supply apparatus, and then,

the sixth supply regulation valve of the fresh third desalting washing-solution supply apparatus is controlled to supply the fresh third desalting washing-solution to the third desalting washing-solution supply apparatus, as the third desalting washing-solution so as to satisfy the third threshold.

[Claim 22]

The desalter for a chlorine-containing powder according to Claim 17, wherein a same apparatus is used as the first solid-liquid separation apparatus and the second solid-liquid separation apparatus and respective treatments by the apparatuses are carried out.