possibility of the RO membrane being clogged.

[Prior Art Document]

[Patent Document]

[0009]

[Patent Document 1] JPH9-192661A

[Patent Document 2] JP2004-066153A

[Patent Document 3] JP2005-246126A

[Patent Document 4] JP2004-283710A

[Summary of the Invention]

[Problems to be solved by the Invention]

[0010]

Embodiments of the present invention provide an ultrapure water production system and a method for producing ultrapure water where water to be treated is subjected to a reduction in boron and TOC components by a primary pure water system and, thereafter, is supplied to a subsystem so that it is possible to stably obtain ultrapure water with reduced concentration of boron without applying a TOC load on the subsystem.

[Means for solving the Problems]

[0011]

According to a first aspect of the present invention, there is provided an ultrapure water production system including, in this order: a pre-treatment system; a primary pure water system; and a secondary pure water system, wherein the primary pure water system includes an ion exchange device which performs treatment on water to be treated containing boron with an ion exchange resin, the ion exchange device includes: a housing portion into which the ion exchange resin is packed; a supply portion through which water to be treated is supplied to the housing portion; and a discharge portion through which treated

water is discharged from the housing portion, and a boron-selective ion exchange resin is packed into a portion of the housing portion on a side of the supply portion, and an ion exchange resin other than the boron-selective ion exchange resin is packed into a portion of the housing portion on a side of the discharge portion of the housing portion, wherein the ion exchange resin has a structure in which the boron-selective ion exchange resin and the ion exchange resin other than the boron-selective ion exchange resin are stacked, and the ion exchange resin other than the boron-selective ion exchange resin is a strongly basic anion exchange resin.

[0012]

According to the above aspect, in the ion exchange device included in the primary pure water system, a boron-selective ion exchange resin is packed into a portion of the housing portion on a side of the supply portion, and an ion exchange resin other than the boron-selective ion exchange resin is packed into a portion of the housing portion on a side of the discharge portion. Accordingly, first, boron is adsorbed and removed by the boron-selective ion exchange resin from water to be treated which is supplied and which contains boron and, thereafter, TOC components eluted from the boron-selective ion exchange resin are adsorbed and removed by the ion exchange resin other than the boron-selective ion exchange resin. With such a configuration, it is possible to supply primary treated water with reduced concentration of boron without applying a TOC load on a subsystem in a later stage. Accordingly, it is possible to stably obtain ultrapure water with reduced concentration of boron. Further, it is also possible to reduce treatment cost caused by an increase in TOC load on the subsystem.

[0013]

In an embodiment, the housing portion may be mounted

in an erected manner, and the supply portion be provided at an upper side of the housing portion, and the discharge portion may be provided at a lower side of the housing portion.

[0014]

According to the above embodiment, water to be treated can be supplied to the housing portion, into which the ion exchange resin is packed, from the supply portion such that the flow direction is directed toward the lower side from the upper side of the housing portion. Accordingly, water to be treated and the ion exchange resins can be efficiently brought into contact with each other and hence, the respective ion exchange resins can exhibit high adsorption capacity. Therefore, boron contained in water to be treated and TOC components eluted from the boron-selective ion exchange resin can be effectively removed.

[0015]

In an embodiment, the ion exchange resin may have a structure in which the boron-selective ion exchange resin and the ion exchange resin other than the boron-selective ion exchange resin are stacked.

[0016]

According to the above embodiment, the ion exchange resin has a two layered structure formed of a boron-selective ion exchange resin and an ion exchange resin other than the boron-selective ion exchange resin. With such a configuration, adsorption efficiency of the above-mentioned respective ion exchange resins can be easily predicted and hence, treatment can be efficiently performed with the ion exchange resins.

[0017]

In an embodiment, the ion exchange device be provided at a downstream end of the primary pure water system.

[0018]

In general, to allow a boron-selective ion exchange

resin to exhibit maximum adsorption capacity, it is preferable that only boron is a load of supplied water to be treated. According to the above embodiment, the ion exchange device having the boron-selective ion exchange resin is provided to the downstream end of the primary pure water system and hence, water to be treated where a load other than a load of boron is reduced can be supplied to the above-mentioned ion exchange device. Accordingly, the boron-selective ion exchange resin can exhibit maximum adsorption capacity so that efficiency of removing boron can be improved.

[0019]

In an embodiment, the ion exchange resin other than the boron-selective ion exchange resin be at least one kind selected from a strongly basic anion exchange resin, a mixture of an anion exchange resin and a cation exchange resin, and an amphoteric ion exchange resin (Invention 5).

[0020]

According to the above embodiment, TOC components eluted from the boron-selective ion exchange resin can be more efficiently adsorbed and removed.

[0021]

According to a second aspect of the present invention, there is provided a method for producing ultrapure water using the above ultrapure water production system.

[Effect of the Invention]

[0022]

According to the ultrapure water production system and the method for producing ultrapure water as per embodiments of the present

Claims

1. An ultrapure water production system comprising, in this order: a pre-treatment system; a primary pure water system; and a secondary pure water system, wherein

the primary pure water system includes an ion exchange device which performs treatment on water to be treated containing boron with an ion exchange resin,

the ion exchange device includes:

a housing portion into which the ion exchange resin is packed;

a supply portion through which water to be treated is supplied to the housing portion; and

a discharge portion through which treated water is discharged from the housing portion, and

a boron-selective ion exchange resin is packed into a portion of the housing portion on a side of the supply portion, and an ion exchange resin other than the boron-selective ion exchange resin is packed into a portion of the housing portion on a side of the discharge portion, wherein

the ion exchange resin has a structure in which the boron-selective ion exchange resin and the ion exchange resin other than the boron-selective ion exchange resin are stacked, and

the ion exchange resin other than the boron-selective ion exchange resin is a strongly basic anion exchange resin.

2. The ultrapure water production system according to claim 1, wherein

the housing portion is mounted in an erected manner, and

the supply portion is provided at an upper side of the housing portion, and the discharge portion is provided at a lower side of the housing portion.

~~3. The ultrapure water production system according to claim 1 or claim 2, wherein~~

~~the ion exchange resin has a structure in which the boron-selective ion exchange resin and the ion exchange resin other than the boron-selective ion exchange resin are stacked.~~

~~4~~3. The ultrapure water production system according to ~~any one of claim 1 to claim 3~~claim 1 or claim 2, wherein

the ion exchange device is provided at a downstream end of the primary pure water system.

~~5. The ultrapure water production system according to any one of claim 1 to claim 4, wherein~~

~~the ion exchange resin other than the boron-selective ion exchange resin is at least one kind selected from a strongly basic anion exchange resin, a mixture of an anion exchange resin and a cation exchange resin, and an amphoteric ion exchange resin.~~

~~6~~4. A method for producing ultrapure water using the ultrapure water production system according to any one of claim 1 to claim ~~5~~3.