CLAIMS

[Claim 1] A concentration apparatus comprising:

the membrane filtration apparatus comprising a membrane that is made from an acid-resistant material, has pores having a pore size capable of capturing microorganisms, and has a surface that has a negative charge in a neutral to alkaline range, wherein the membrane is made from an acid-resistant material that withstands pH 2 or lower;

a sample water supply disposed upstream of the membrane filtration apparatus and configured to supply sample water;

an acidic solution storage tank disposed upstream of the membrane filtration apparatus in parallel with the sample water supply and configured to store an acidic solution;

an alkaline solution storage tank disposed upstream of the membrane filtration apparatus in parallel with the sample water supply and the acidic solution storage tank and configured to store an alkaline solution;

an upstream pipe configured to supply the sample water from the sample water supply to the membrane filtration apparatus;

a washing solution supply pipe branched from and connected to the upstream pipe and configured to supply a washing solution of strong acid having a pH of 2 or lower to wash the membrane filtration apparatus;

an outlet disposed downstream of the membrane filtration apparatus and configured to discharge fluid externally; and

a collection container disposed downstream of the membrane filtration apparatus in parallel with the outlet and configured to collect fluid.

[Claim 2]

The concentration apparatus according to claim 1, the membrane filtration apparatus further comprises:

a pressure vessel that is pressure resistant, wherein

the membrane is held in the pressure vessel.

[Claim 3] The concentration apparatus according to claim 1 or 2, further comprising a washing solution discharge pipe downstream of the membrane filtration apparatus and configured to discharge the washing solution.

[Claim 4] A concentration method executed by

a concentration apparatus comprising:

a membrane filtration apparatus comprising a membrane that is made from an acid-resistant material that withstands pH 2 or lower, has pores having a pore size capable of capturing microorganisms, and has a surface that has a negative charge in a neutral to alkaline range;

a sample water supply disposed upstream of the membrane filtration apparatus and configured to supply sample water;

an acidic solution storage tank disposed upstream of the membrane filtration apparatus in parallel with the sample water supply and configured to store an acidic solution;

an alkaline solution storage tank disposed upstream of the membrane filtration apparatus in parallel with the sample water supply and the acidic solution storage tank and configured to store an alkaline solution;

an upstream pipe configured to supply the sample water from the sample water supply to the membrane filtration apparatus;

a washing solution supply pipe branched from and connected to the upstream pipe and configured to supply a washing solution of strong acid having a pH of 2 or lower to wash the membrane filtration apparatus;

an outlet disposed downstream of the membrane filtration apparatus and configured to discharge fluid externally; and

a collection container disposed downstream of the membrane filtration apparatus in parallel with the outlet and configured to collect fluid,

the concentration method comprising:

filtering the sample water by supplying the sample water from the sample water supply to the membrane filtration apparatus;

acid washing the membrane by supplying the acidic solution from the acidic solution storage tank to the membrane filtration apparatus;

purifying a concentrate of microorganisms captured by the membrane by supplying the alkaline solution from the alkaline solution storage tank to the membrane filtration apparatus; and

washing the membrane filtration apparatus by supplying the washing solution from the washing solution supply pipe to the membrane filtration apparatus.