CLAIMS

1. Method for treating water comprising:

a step for putting said water into contact with an adsorbent powdery material in a concentration of 0.1 to 5 g/L in a membrane reactor containing at least one submerged filtration membrane;

a step of filtration by submerged membrane of said water containing said adsorbent powdery material in said membrane reactor, said membrane being at least partly constituted by an organic material;

wherein the method includes steps aimed at limiting the abrasion of said at least one submerged membrane by said adsorbent powdery material, said steps consisting in:

putting said water containing said adsorbent powdery material into contact, in said membrane reactor, with a particulate polymer material constituted by particles in a concentration of 1 g/L to 10 g/L, said particles having an average diameter of 1 mm to 5 mm and a relative density of 1.05 to 1.5; and

stirring said mixture constituted by water, adsorbent powdery material and particulate polymer material within said membrane reactor containing said at least one filtration membrane.

2. Method according to claim 1, wherein said stirring of said mixture constituted by water, particulate polymer material and adsorbent powdery material within said membrane reactor results, at least partly, from the sequenced or non-sequenced injection of air into said mixture.

3. Method according to claim 1 or 2, wherein said stirring of said mixture constituted by water, particulate polymer material and adsorbent powdery material

within said membrane reactor results, at least partly, from a recirculation of at least one part of said mixture constituted by water and adsorbent powdery material in said reactor.

4. Method according to any one of the above claims, wherein said adsorbent powdery material is powdered activated carbon (PAC).

5. Method according to one of the above claims, wherein said polymer material is chosen from the group comprising polypropylene beads, carbonated polypropylene beads, hollow polypropylene beads filled with minerals, polycarbonate beads, polyurethane beads, polymethylmethacrylate beads, polybutylene terephtalate beads, polyoxymethylene beads, polyethylene beads, and polyvinyl chloride beads.

6. Method according to one of the above claims, wherein said water to be treated circulates in said membrane reactor at a speed of 3 to 15 m/h.

7. Method according to one of the above claims, wherein said submerged membrane is chosen from the group constituted by nanofiltration membranes, ultrafiltration membranes and microfiltration membranes.

8. Method according to one of the above claims, further comprising a step for injecting ozone into the water to be treated, said step for injecting ozone being possibly carried out upstream to said membrane reactor or in said membrane reactor.

9. Plant for treating water for implementing a method according to any one of the claims 1 to 8 comprising:

at least one membrane reactor integrating at least one membrane filtering unit comprising at least one filtration membrane;

means for conveying water to be treated into said at least one membrane reactor;

means for injecting an adsorbent powdery material into said water to be treated;

means for recirculating at least a part of the content of said membrane reactor;

a particulate polymer material constituted by particles having an average diameter of 1 mm to 5 mm, and a relative density of 1.05 to 1.5 present in said membrane reactor in a concentration of 1 to 10 g/L ;

means for retaining said particulate polymer material inside said membrane reactor;

means for stirring said content of said membrane reactor;

means for discharging water coming from said membrane filtration unit;

means for draining the mixture of water and adsorbent powdery material and excess sludges coming from said membrane reactor.

10. Plant according to claim 9 wherein said polymer material is chosen from the group comprising polypropylene beads, carbonated polypropylene beads, hollow polypropylene beads filled with minerals, polycarbonate beads, polyurethane beads, polymethylmethacrylate beads, polybutylene terephtalate beads, polyoxymethylene beads, polyethylene beads, and polyvinyl chloride beads.

11. Plant according to any one of the claims 9 or 10, wherein said membrane reactor comprises:

a zone of pre-contact of said water with said adsorbent powdery material into which there lead said means for conveying water to be treated, said means for injecting said adsorbent powdery material leading into said zone for putting into contact or into said means for conveying water to be treated; and

a membrane filtration zone;

said pre-contact zone and said filtration zone being physically separated from each other, said plant comprising means for conveying the content of said zone of pre-contact into said filtration zone.

12. Plant according to any one of the claims 9 to 11, wherein said means for stirring the content of said membrane reactor comprise at least one air injection bar to be placed inside said membrane reactor.

13. Plant according to claim 12, wherein said air injection bar is to be placed in said zone of pre-contact.

14. Plant according to any one of the claims 9 to 13, wherein said means for stirring the content of said membrane reactor comprise said means of recirculation of at least one part of the content of said membrane reactor.

15. Plant according to one of the claims 9 to 14, further comprising means for injecting ozone into said water to be treated.