Patent Claims

1. A membrane filter for filtering a liquid to be filtered, the membrane filter comprising:

a. a base element that is open in a downward direction and flowable by a gas and the liquid and that includes a tubular shell and precisely one membrane carrier arranged therein, wherein the membrane carrier is connected with the tubular shell through at least one anchor location;

b. hollow fiber membranes attached on top in the membrane carrier and respectively including a lumen into which the a liquid permeate is filterable from the liquid;

c. a circumferentially closed tube which adjoins the tubular shell at a top and which envelops the hollow fiber membranes;

d. a gas inlet for letting the gas into the base element;

e. at least one permeate collecting cavity which is connected with the lumens of the hollow fiber membranes for collecting the permeate from the hollow fiber membranes;

f. at least one permeate outlet for draining the permeate from the at least one permeate collecting cavity; and

g. at least one downward open flow cavity between the shell and the membrane carrier for flowing the liquid through, wherein the at least one flow cavity includes an outlet on top for letting the liquid out into the tube, wherein the at least one flow cavity in each horizontal section through the membrane carrier is adjacent to the shell and also adjacent to the membrane carrier, and wherein the at least one flow cavity envelops the membrane carrier and forms an annular gap, wherein the annular gap is only interrupted by the at least one anchor location, wherein a height of the at least one flow cavity is defined by an overlap portion of a height of the membrane carrier and a height of the shell, and wherein the membrane carrier completely closes the base element besides the at least one flow cavity for a flow of the liquid from a bottom to a top;

characterized in that

h. the base element is flowable sequentially from the gas inlet through the at least one flow cavity to the outlet;

i. the at least one flow cavity includes bulges extending into the membrane carrier.

2. The membrane filter according to the preceding claim , characterized in that the membrane carrier includes fingers which are formed by the bulges and which are connected by an anchor of the membrane carrier.

3. The membrane filter according to one of the preceding claims, characterized in that the membrane carrier is connected with the shell by a maximum of two anchor locations which are arranged in an extension of the anchor.

4. The membrane filter according to one of the preceding claims, characterized in that the that the membrane carrier is completely separate from the shell in each horizontal section above the at least one anchor location.

5. The membrane filter according to one of the preceding claims, characterized in that the at least one flow cavity forms at least one flow channel in at least one of the horizontal sections, wherein the flow channel has a uniform width over more than 80% of its length.

6. The membrane filter according to one of the preceding claims, characterized in that the membrane carrier has a cross section in the horizontal sections which cross section decreases in a downward direction.

7. The membrane filter according to one of the preceding claims, characterized in that the base element includes the gas inlet for letting the gas into the base element.

8. A method for filtering a liquid in a membrane filter, wherein the membrane filter includes

a base element,

a circumferentially closed tube, and

a gas inlet,

wherein the base element includes a tubular shell, and

precisely one membrane carrier arranged in the base element and connected by at least one anchor location with the tubular shell,

wherein hollow fiber membranes are attached on top in the membrane carrier,

wherein the circumferentially closed tube adjoins the tubular shell at a top;

wherein the base element includes at least one flow cavity between the shell and the membrane carrier,

wherein the flow cavity has an outlet on top leading out of the base element into the tube,

wherein the at least one flow cavity in each horizontal section through the membrane carrier is adjacent to the shell and also adjacent to the membrane carrier, and

wherein the at least one flow cavity envelops the membrane carrier and forms an annular gap, wherein the annular gap is only interrupted by the at least one anchor location, wherein a height of the at least one flow cavity is defined by an overlap portion of a height of the membrane carrier and a height of the shell,

wherein the membrane carrier completely closes the base element besides the at least one flow cavity for flowing the liquid from a bottom to a top, and

a. wherein the liquid flows into the base element, flows through the at least one flow cavity and thus flows around the membrane carrier;

b. a gas flows through the gas inlet into the base element,

c. the liquid only flows through the outlet on top of the base element out of the base element and only flows through the outlet into the tube,

d. the gas flows out at a top of the base element into the tube and rises in the tube and thus generates an upward movement of the liquid in the membrane filter,

e. the rising liquid and the gas flush the hollow fiber membranes on an outside,

f. a pressure differential is provided between an outside of the hollow fiber membranes and lumens of the hollow fiber membranes, wherein the pressure differential causes a liquid permeate to be filtered out of the liquid and to flow into the lumens of the hollow fiber membranes, and

g. the permeate from the lumens is collected and flows out of the membrane filter,

characterized in that

h. the gas flows through the gas inlet into the at least one flow cavity, and subsequently

i. the gas flows together with the liquid through the base element in the at least one flow cavity between the shell and the membrane carrier and flows through the outlet into the tube,

j wherein the at least one flow cavity includes bulges extending into the membrane carrier.

9. The method according to claim 8, characterized in that the liquid and the gas flow completely around the membrane carrier in at least one of the horizontal sections through the membrane carrier.

10. The method according to one of the claims 8 or 9 or 10, characterized in that the membrane filter is submerged in the liquid.

11. The method according to one of the claims 9 or 10, characterized in that the liquid is supplied to the base element by a first liquid conduit and let out from the membrane filter on top by a second liquid conduit.