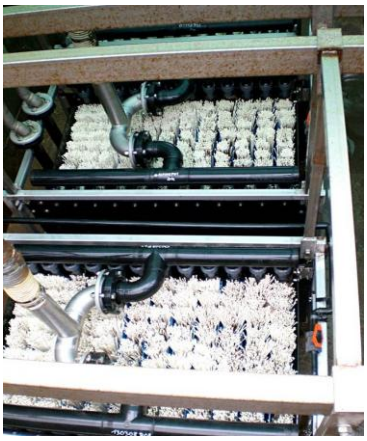
MBRs are activated sludge waste water treatment plants where final clarification (biomass/water separation) is not performed by means of a settler, but by means of specific microporous membranes. Membrane modules have a porosity rate of about some hundredths microns, and are equipped with a continuous air cleaning device to prevent clogging, which guarantees the membrane a duration of several years. MBR's treatment performances are the highest, because it is possible to operate with high biomass concentration and treated water quality is guaranteed.

MBR (Membrane Bio Reactor) biological processes couple microfiltration with conventional activated sludge processes.

Among several types of membranes available in the marketplace, CID focused only on "hollow fiber" (picture 1) and "plane panels" (picture 2) ones, because of their combination of reliability, effectiveness and good performances.

Single filtering elements, both "hollow" and "plane" type, are mainly composed of an ABS or PE made frame, over which a porous sheet is applied; all elements are put together and hydraulically connected in one module. This module, alone or with other modules depending on the required capacity, is directly immersed in the biomass.



Picture 1 – "hollow fibers" membranes

Picture 2 – "plane panels" membranes

Typical layout o fan MBR plant is shown in picture 3: suction of treated water through the membrane is carried out from external to internal, by means of the negative pressure generated by an external suction pump: liquors are attracted towards the membrane, but only water goes across it through porosity, while biomass (activated sludge) remains outwords, in the process. Membrane surface, during extraction, is constantly "washed" by an air flow ("scouring air") blown from the bottom by means of an external blower, to remove the sludge amassed over it. Membranes are not to be considered as simple "filters", because the cleaning device just described is integral part of the system, and it is as effective to keep filtering units always clean. Durability of membranes is several years. Usually, only a maintenance chemical clearing could be foreseen once or, at worst, twice a year. Chemical cleaning is easily carried out by a backflow sodium hypochlorite injection into the permeate line, and it takes only a few hours.

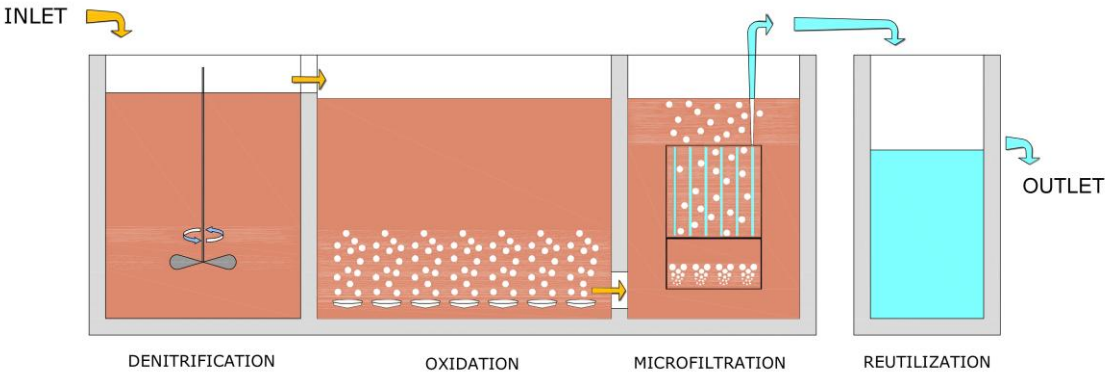
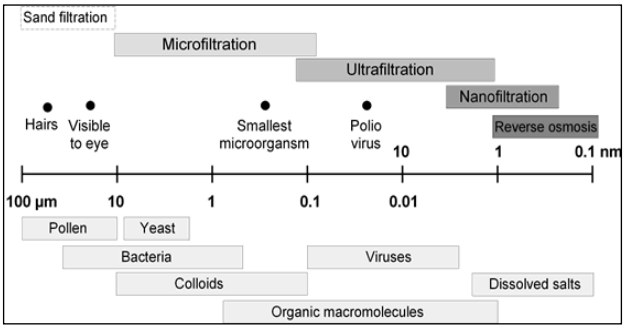


Fig. 3 – typical MBR layout

Membranes, depending on the type, have porosity size from 0,4 up to 0,04 µm (micron), and belong to micro - ultra filtration class, the last level before nanofiltration and reverse osmosis (picture 4).

That is why MBR employment guarantees performances much higher than conventional treatments, in particular total removal of both suspended solids and of bacteria, as well as to simplify and make safer the process.



Picture 4 – Filtration ranking

MBR systems, contrary to conventional plants, are not affected by settleability characteristics of the sludge, therefore they can operate with much greater biomass (sludge) concentrations, which guarantee higher biological kinetics: because of this, smaller reactor's volumes are required to obtain the same performances of conventional plants. Furthermore, membranes fully replace the final settler, that is not necessary anymore; space saving is another strenghtness of MBRs plants.

Picture 5 – **3.000 P.E.** MBR treatment plant

STRENGHTNESS OVER CONVENTIONAL TREATMENTS:

- Treatment capacity 2-3 times greater because of higher biomass cocentration
- Treated water quality is guaranteed and not affected by low settleability of sludge
- Lower biomass growth, less excess sludge to be disposed (down to 20%)
- Treated water is perfectly clear and bacteria free (disinfection is not necessary)
- Suitable for upgrading of already existing treatment plants and for prefabricated/containerized/mobile treatment plants (picture 7)
- Suitable for reuse/potabilization of treated water

MBR's find their best applications where is necessary to contain plant's dimensions because of the little space available, or where a high treatment rate must be guaranteed. Also, where industrial waste waters has to be treated, over all with "difficult" and/or hi-loaded ones. Some examples:

- Treatment plants discharging in "sensitive" areas (picture 6)
- Enhancement/upgrading of existing plant, reusing existing tanks
- Treatment of industrial waste waters (dairies, slaughterhouses, wineries, distilleries, tanneries, landfills…)
- Treated water reuse

Picture 6 – **150 A.E.** municipal MBR plant – summit of Monte Lussari – ITA (1680 mt. over sea level)

MBBR technology, because of lower reactor's volumes and operational simplicity, is also very suitable for design and construction of compact mobile containerized treatment plants (picture 7).

Picture 7 – **100 P.E.** containerized MBR plant

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