

Case study 2.1 Baleen whales inspire an industrial filtration system

When it feeds, a baleen whale traps small organisms with its baleen plate, as described in section 2.3.1. The organisms are then brushed by the tongue down the whale's throat. The baleen plate is cleaned by reversing the water flow and agitating the tongue. The immediate cleaning of its filter between each round of feeding is essential if the whale is to maintain a reliable feeding apparatus that does not become clogged.

Australian engineers designed an industrial filtration system inspired by the design and hydrodynamics of whale baleen feeding systems as shown in Figure A. Now marketed under the Baleen trademark, it is described as an efficient self-cleaning filtration system for separating particulates from industrial waste water streams.

Its advantages over other systems are its low cost, low energy use and low maintenance, while it is highly effective, reliable and can be customized to specific types of particulate suspensions. As water moves through the filter, suspended particles are left

behind. These systems can accomplish coarse screening to 250 μm particles, micro screening to less than 100 μm particles or micro filtration to less than 5 μm (with chemical assistance).

One of the key features of this system, that was inspired by the whale feeding mechanism, is the so-called 'double act' of two high pressure, low volume sprays that clear the filter continuously, shown in Figure A. One spray dislodges the material caught in the filter, by a reverse flow, and the other sweeps it away for collection, just as the whale may reverse flow through its filter and use its tongue to sweep away the filtered food particles from its baleen filter.

Find out more:

Werth AJ (2004). Models of hydrodynamic flow in the bowhead whale filter feeding apparatus. *Journal of Experimental Biology* 207: 3569–3580.

Pivorunas A (1979). The feeding mechanisms of baleen whales. *American Scientist* 67: 432–440.

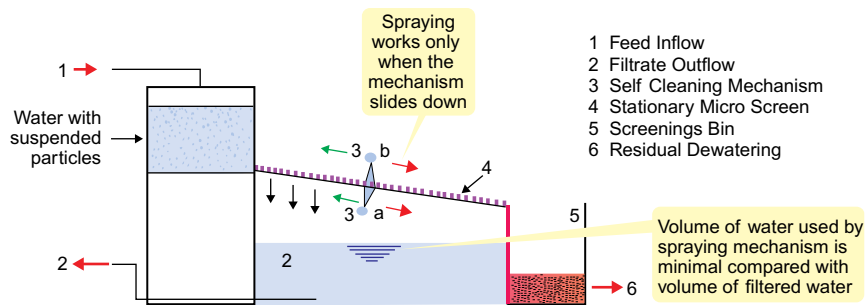


Figure A Diagram of an industrial filtration system based on the 'baleen principle'.

Water with suspended materials in it (1) flows over the filtration screen made of stainless steel (4). The filtrated water collects in a reservoir below (2) and is removed via the filtrate outlet. Solids that cannot pass through the screen are left behind. A double spray mechanism (3) slides over the filtration screen at regular intervals to remove solids that accumulate on the screen. One high pressure, low volume spray from below (3a) dislodges the material accumulating on top of the screen, while the other high pressure, low volume spray (3b) pushes the material along on the top of the screen to be collected in the screenings bin (5) when the mechanism slides down indicated by the red arrows. Spraying stops when the mechanism moves back, indicated by the green arrows. Water with high residual concentrate collected in the screening bin is removed through a residual dewatering outlet (6).

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