

# Foam: An Introduction

Robin Pike

Observations of foam (spume) on mountain streams and near lakeshores can be alarming and may immediately raise suspicions of pollution. But while frothy water in some cases may indicate pollution, it usually results from natural processes.



Dave Scott

exposed to prevailing winds, in eddies, in areas of slow moving water, in pools, and behind rocks.

Depending on chemical composition, foam can be white to yellow. Foam caused by pollution (i.e., soap or detergent) is usually white. Foam can also be stained brown from humic acids (another plant breakdown product) that may be especially noticeable in tea-coloured waters or boggy areas with large accumulations of organic material (R. Nordin, pers. comm., 2003).



Rick Nordin

## Is Foam Harmful?

Natural foam is usually harmless as approximately 1% of the foam is surfactant while the remaining 99% is water and air (IDEM 2002). However, excess foam sometimes indicates imbalances in an aquatic system (e.g., excess phosphorous) and may indicate a need for further assessment.

Foam caused by pollutants, as well as the pollutants themselves, can be directly harmful to aquatic life for various reasons not detailed here. Foam is usually undesirable in drinking water because surfactants



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## How and Why Does Water Foam?

Water bodies containing large amounts of organic material can form spume when surfactants (e.g., non-soluble fatty acids) are released during decomposition. A surfactant, or surface-active agent, is a compound that lowers the surface tension of a liquid and makes the water surface foam more easily. Examples of surfactants include soaps, non-soluble fatty acids, and synthetic detergents. Wind, waves, and flowing water agitate the surfactant at the water surface resulting in the entrainment of air bubbles. Foam then builds and stabilizes on the water surface as air bubbles, water, surfactant, and small pieces of organic debris and/or other materials form the foam's matrix. Foam will often accumulate along lake margins

## Natural Versus Pollution-Caused Foam: What's the Difference?

Distinguishing between natural and pollutant-caused spume can be difficult. Smell may provide a clue as to the source—natural foam often smells earthy or fishy whereas foam derived from pollutants may have a perfumy or soapy odour. Foam that is persistent and cannot be easily brushed apart is likely caused by pollution. Natural spume, in contrast, is usually short lived, breaking down quickly after agitation from wind or wave action ceases.

Some watershed managers use the simple "shake test." In a medium-sized container (0.5–1 litre), shake a sample of spumous water. Natural foam will dissipate upon agitation whereas foam from detergents will generally increase.

may impart an unpleasant taste and cause frothing. Regardless of whether foam is present, any untreated surface water should be appropriately tested and disinfected before consumption to ensure safe drinking water. ~

### Reference

Indiana Department of Environmental Management (IDEM). 2002. Foam. Fact sheet. Available from: [www.in.gov/idem/water/assessbr/surveys/025surfacefoam.pdf](http://www.in.gov/idem/water/assessbr/surveys/025surfacefoam.pdf)

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# FOAMING OF SURFACE WATERS: A NATURAL PHENOMENON ON ONTARIO LAKES

## **WHAT CAUSES THE FOAMING OF SURFACE WATERS ON SOME ONTARIO LAKES?**

The foaming of surface waters on lakes is not a new phenomenon. It is a natural process that has been going on for a long time. All lakes contain organic matter, such as algae, rooted aquatic plants and leaves. When this organic matter decomposes through natural bacterial action, it releases cellular products to the water, which form a surfactant, or surface agent. A surfactant simply lessens the surface tension of the water, making it susceptible to foaming. When the wind blows, the waves on the lake agitate this surface agent, thus transforming it into sudsy white foam.

Natural foam is most noticeable along beaches exposed to the prevailing wind direction. When the foam reaches the shoreline, it tends to form a loose line where it mixes with tiny pieces of organic matter, which act as a binding agent and give it stability.

## **IS THIS FOAM HARMFUL TO FISH OR HUMANS?**

Foam on surface waters is a harmless by-product of our lakes. Its chemical makeup is 99 per cent air and water, combined with one per cent or less surfactant.

## **WHAT ABOUT FOAM OF A POLLUTANT TYPE THAT MAY BE SEEN ON SOME LAKES?**

Back in the 1950's, manufacturers of laundry detergents marketed a type of product that was highly resistant to chemical breakdown. As a result, there was a foaming problem in the vicinity of all sewage treatment plant outfalls. Rivers with a bit of turbulence would often sprout huge, foaming white islands. In the early 1960's, detergent manufacturers developed a new formula, which was designed to remain stable only for short periods of time before breaking down into its components. This largely solved the problem of the foaming of surface waters downstream of sewage treatment plants.

## **WHY DOES NATURAL FOAMING OCCUR ON THE SURFACE OF SOME LAKES AND NOT OTHERS?**

The appearance of natural foam on a lake is determined by the amount of organic plant material in the lake and the size of the area of open water (and thus its ability to provide extended wave action). Organic material, such as algae and vascular aquatic plants, lignins, tannins and fulvic acid, accumulate in lakes after periods of heavy rainfall. Decomposition of this organic material produces compounds that are similar to the fatty acids used in soaps. Softwater lakes of the pre-Cambrian shield have a greater amount of these compounds and lower surface tension than hard-water Great Lakes, thus making them more susceptible to foaming.

In lakes where there is a long fetch (the distance from shore to shore in the direction of the wind), constant winds can induce a circulation pattern (Langmuir circulation) to occur. This circulation pattern causes foam, generated by wave action, to collect in long streaks (Langmuir streaks). Langmuir streaks are natural occurrences, composed of particulates and surface-active materials collected together in long ridges. When Langmuir streaks impinge on a shore, piles of foam may accumulate.