

Occurrence of a Stable Foam in the Upper Rhine River

Caused by Plant Derived Surfactants

*CHRISTIAN WEGNER AND MATTHIAS HAMBURGER**

Supporting Information

10 Pages, containing 7 Figures and 2 Tables

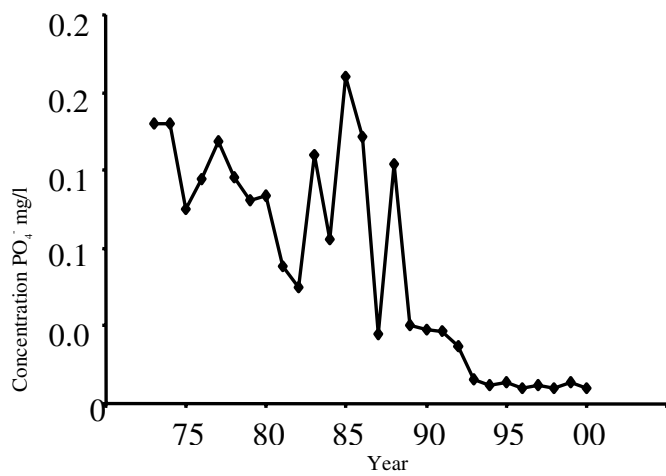


Figure 1. Phosphate concentration (mg/L, yearly average) in Rhine river, monitored in Schaffhausen 1973-2000.

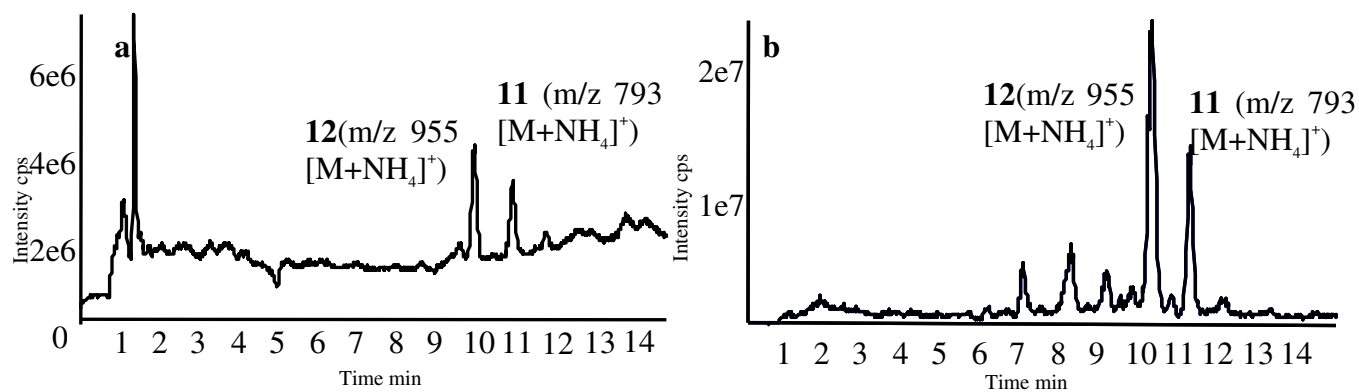


Figure 2. ESI LC-MS of glyceroglycolipids. **a**, Chromatogram in the SIM mode, foam sample of 25.08.1998. **b**, reconstructed ion chromatogram of a crude plant extract.

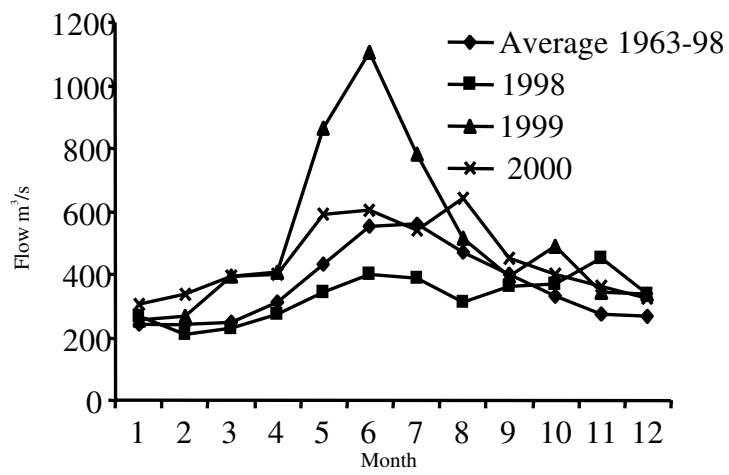


Figure 3. Flow (m³/s) of the Rhine River. Monthly average, calculated on basis of daily monitoring.

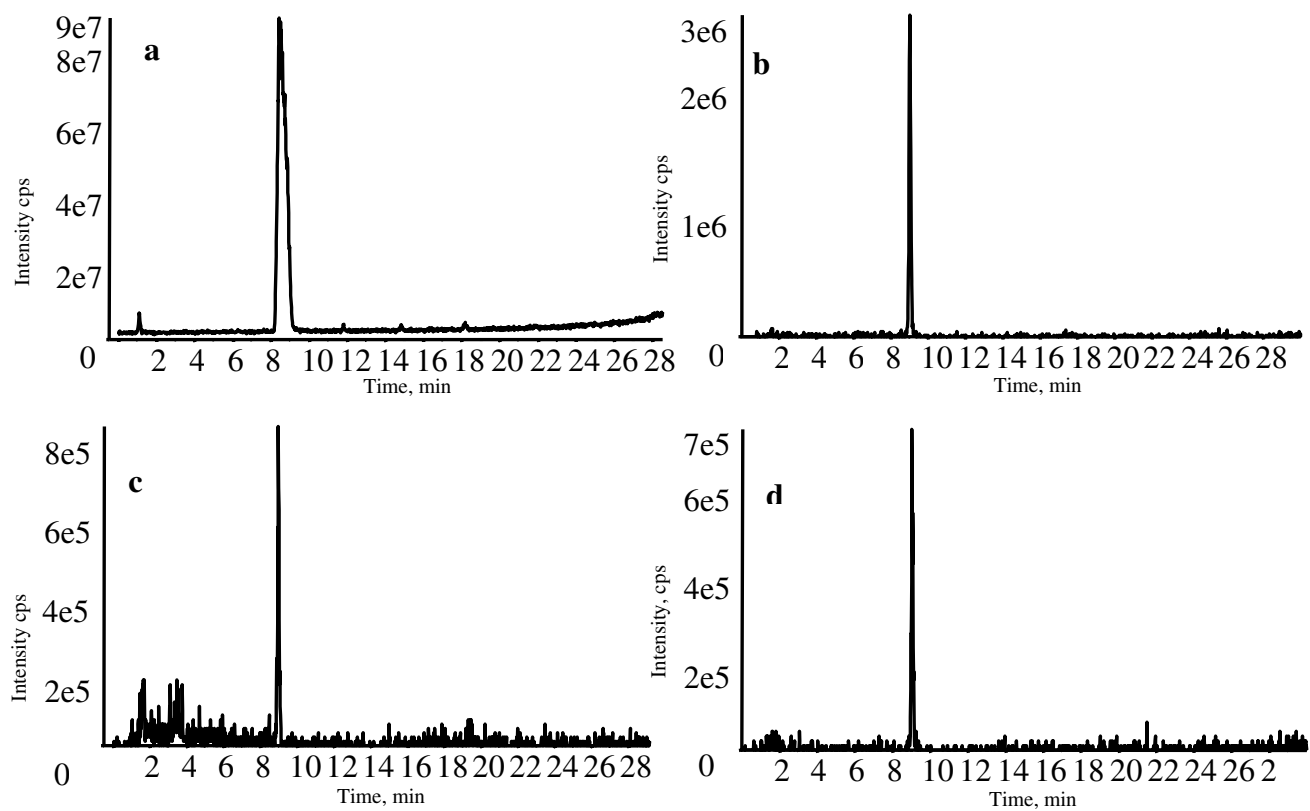


Figure 4. ESI LC-MS analysis of SDS. **a**, TIC of SDS standard. **b**, XIC m/z 165 of water sample 05.06.2000. **c**, XIC m/z 165 of foam sample 02.08.2000. **d**, XIC m/z 165 of water sample 02.08.2000. No foam formation was observed on 05.06.00

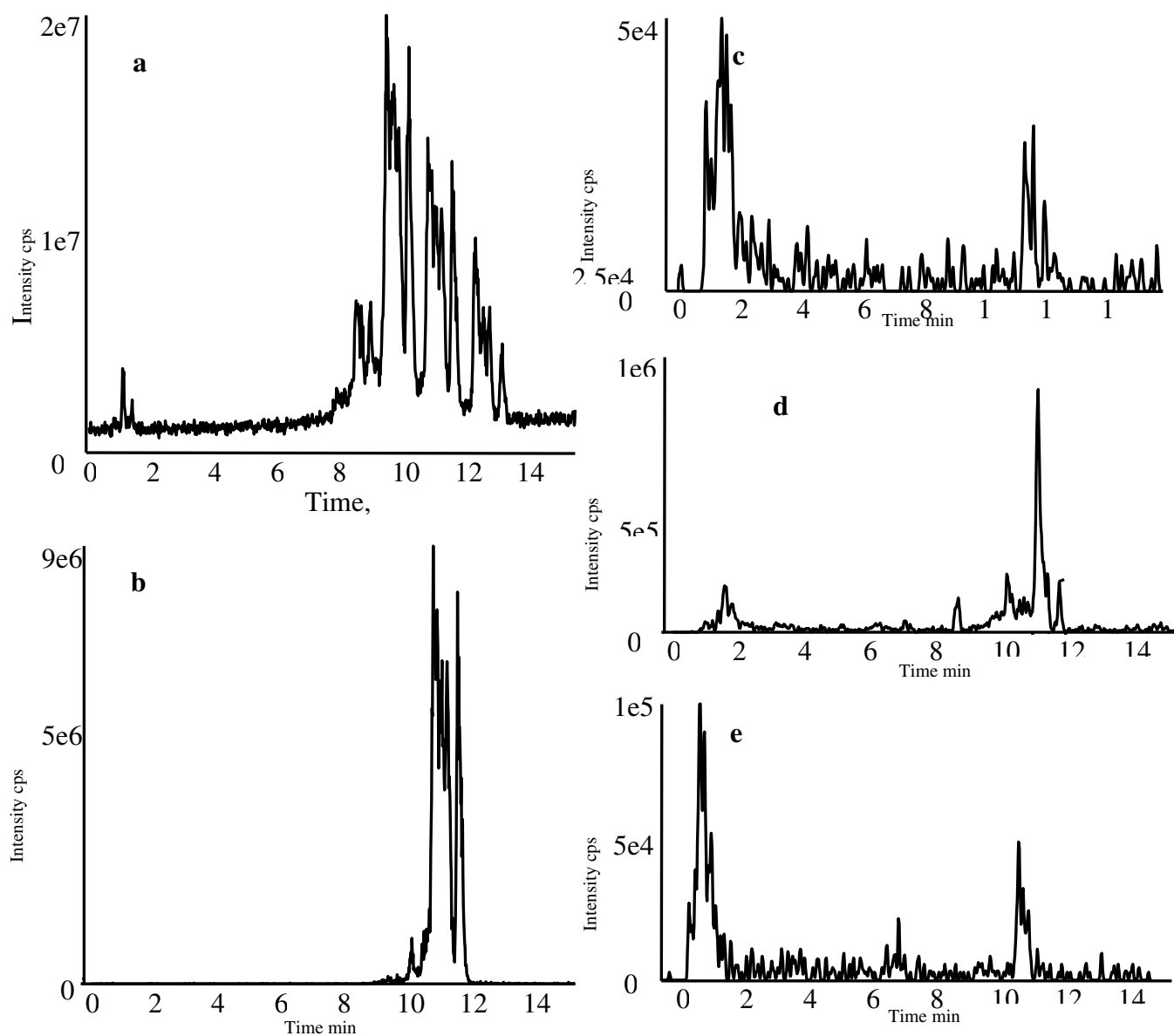


Figure 5. ESI LC-MS analysis of LAS in environmental samples. **a**, TIC of standard LAS mixture. **b**, Extracted ion chromatogramme (XIC) m/z 325 of standard LAS mixture. **c**, XIC m/z 325 of water sample 02.08.2000. **d**, XIC m/z 325 of foam sample 02.08.2000. **e**, XIC m/z 325 of water sample 05.06.2000. No foam formation was observed on 05.06.2000.

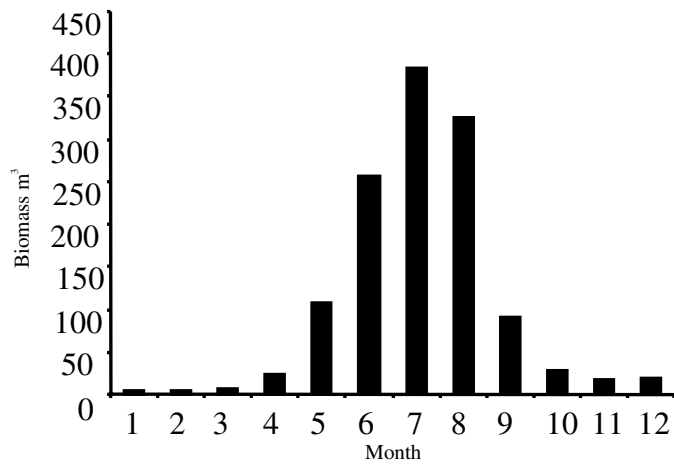


Figure 6. Plant biomass (m^3) collected at hydroelectric power plant, Schaffhausen (monthly averages 1977-1999).

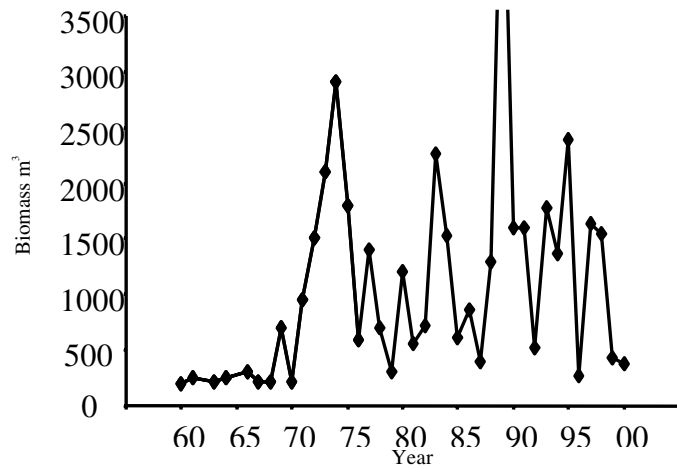


Figure 7. Cumulative plant biomass (m^3) per year collected at hydroelectric power plant Schaffhausen 1960-2000 (1989: 5200 m^3).

Table 1 Concentrations of humic substances in water samples of the Rhine River.

	03.04.2000	02.05.2000	05.06.2000	03.07.2000
DOC [mg/L]	2.28	1.89	1.92	1.90
HS [mg/L]	1.03	0.61	0.48	0.97
PS [mg/L]	0.06	0.09	0.16	0.41
DOC dissolved organic carbon; HS humic substances; PS polysaccharides				

Table 2. Results of the toxicological testing of *R. fluitans* extract, purified fractions and environmental samples on selected indicator organisms.

	<i>D. magna</i>	<i>A. salina</i>	<i>B. calyciflorus</i>	<i>B. glabrata</i>	<i>A. aegypti</i>
MeOH extract 10 ppm	no effect	no effect	no effect	no effect	no effect
Saponins at 100 ppm	no effect	no effect	no effect	no effect	no effect
MGDAG at 100 ppm	no effect	no effect	no effect	no effect	no effect
DGDAG at 100 ppm	no effect	no effect	no effect	no effect	no effect
H ₂ O ^{a)} 25.08.98	no effect	not tested ^{b)}	no effect	no effect	no effect
H ₂ O ^{a)} 02.05.00	no effect	not tested ^{b)}	no effect	no effect	no effect
H ₂ O ^{a)} 10.08.00	no effect	not tested ^{b)}	no effect	no effect	no effect
H ₂ O ^{a)} 02.10.00	no effect	not tested ^{b)}	no effect	no effect	no effect
foam ^{a)} 25.08.98	no effect	not tested ^{b)}	no effect	no effect	no effect
foam ^{a)} 10.08.00	no effect	not tested ^{b)}	no effect	no effect	no effect
foam ^{a)} 02.10.00	no effect	not tested ^{b)}	no effect	no effect	no effect

^{a)} Environmental samples from the Rhine River

^{b)} *Artemia salina* requires sea water for assay.