

Leaching of Kevlar

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Introduction

In April 1993 Jagam gave me a sample of Kevlar and a sample of Vectran for leaching tests. I noted then that Kevlar leached much worse than Vectran. Now that Kevlar has been chosen for the AV ropes, I have repeated these tests to see if there is any problem associated with this leaching.

Tests

The first sample of kevlar (#1) I heated in DI water for 25 days at 53C and then left in the lab at 24C. The second sample (#2), obtained in June 1994, I immersed at 24C. After 63 days, I sent water from #2 for ICP testing at Cantest¹.

Results

Using a scaling factor of two per 10C raise in temperature, I translated all times into "SNOdays" at 8.5C.

Sample #1 showed an initial ion leaching rate fraction of 1.1×10^{-5} per SNOday by mass, topping out at a total loss fraction of 4.6×10^{-3} . If I fit this to an exponential form I get a mean time of $\tau = 14$ SNOmonths. For a total rope mass of 110 kg, this would translate into an initial load of the water system of 30 g in the first 25 day period.

Sample #2 showed an initial ion leaching rate fraction of 1.7×10^{-5} per SNOday by mass, or about double that of sample #1. For a total rope mass of 110 kg, this would translate into an initial load of the water system of 40 g in the first 25 day period. This difference may reflect the sample differences or the different temperatures to which they were subjected.

The ICP test (only sensitive to metals) of sample #2 showed that more than 95% of the metal ions were Na^+ . No heavy metals were observed and the detection limit for lead was such that it must constitute less than 2% of all metal ions.

In similar tests on Vectran I never observed any measurable ionic leaching.

Conclusion

The leaching of Kevlar is probably all in the form of sodium salts which is not intrinsically harmful. If the loading on the water system is a problem, then the ropes could be soaked in DI water before use. However, the long leaching mean time of 5 months at lab temperatures should be considered.

kevlar.tex

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