

Niskin Bottle O-Rings can be Toxic to Phytoplankton

Originated on November 30, 2010

Originated from: Andrew Woogen (MLML) on Tue, 30 Nov 2010

Two different scientists have informed me about the contamination problems they face when seawater samples are taken by Niskin bottles with O-rings made with Buna-N.

They probably leach plasticizers or other toxic materials into the seawater sample.

Sea-Bird offers Niskin bottles from outside companies like General Oceanics and OceanTest Equipment inc.

Buna-N is the standard O-ring material for an OceanTest Equipment inc, Niskin bottle.

Has anyone tackled this issue before and found a good replacement?

Attached is a graph of the "sinking gun" <[GulperBunaSlides.pdf](#)>.

Andrew

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Andrew Woogen
Marine Technician
Moss Landing Marine Labs
Marine Operations, R/V Point Sur
7539 Sandholdt Rd.
Moss Landing CA 95039

Reply from: Jim Happell on Tue, 30 Nov

While I am not discounting the evidence of no plankton growth from the experiment presented, I am contesting the claim that the Buna-n leaches plasticizers. I am in the business of measuring CFCs and SF6 from Niskin bottles. Our analysis is extremely sensitive, measuring less than 10^{-15} molar concentrations, and is also very sensitive to contamination from plasticizers or other dissolved organic compounds. Buna-N seems fine to

use for CFC analysis. Viton is also fine for CFCs, and probably a better choice. Based on some experiments I did with silicone peristaltic pump tubing it would be a poor choice, because it does leach plasticizers.

Jim Happell
UM/RSMAS
4600 Rickenbacker Cswy.
Miami, FL 33149

Reply from George Tupper (WHOI) on Wed, 01 Dec 2010

Andrew,

We often use the orange-colored ones (I'm at home at the moment and can't remember the material) on the external parts of the bottles (petcocks and vents) simply because it seems to last much longer before cracking. Other than that we use Buna N.

George

Reply from George Tupper on Dec 1, 2010:

All,

I just remembered, we sometimes do cooperative work with Bill Smethie(LDEO), and he insists on using Buna-N O-rings which are baked in a vacuum chamber to eliminate any residual cfc contamination.Â Perhaps Bill has some ideas...

George

Reply from Jim Happell on Wed, 01 Dec 2010

I also sample groundwater for CFCs and SF6 and needed to find a tubing material I could use in a peristaltic pump. I found that Viton tubing works very well. Pumping water through tubing that is constantly being compressed in a peristaltic pump, is a much more demanding way to test for leachable organics, than having o-rings in contact with water in a Niskin, so in my opinion Viton o-rings should also work for CFCs

Reply from Dale Chayes (LDEO) on Wed, 1 Dec 2010

On Dec 1, 2010, at 7:39 , George Tupper wrote:

> All,

>

> I just remembered, we sometimes do cooperative work with Bill Smethie(LDEO), and he insists on using Buna-N O-rings which are baked in a vacuum chamber to eliminate any residual cfc contamination. Perhaps Bill has some ideas...

I know that Bill has the Buna-N O-rings we use for our Thin Hole Rosette baked before we use them.

I've asked for details.

-Dale

Reply from: Marc Willis (OSU) on Wed, 1 Dec 2010

Andrew,

For at least 25 years, we (OSU) have replaced the deadly black O-rings in Niskin Bottles with silicone O-rings. These are orange or red, and are available in standard sizes from a number of suppliers. All O-rings in Niskin bottles (from whatever source) are standard sizes.

At the insistence of some of the more anally-retentive users, we also replaced the small O-rings in the drain and vent valves.

The silicone O-rings have a shorter life than the vile black ones, and have to be changed more often. They tend to age and become brittle or "harder" faster, and do not wear as well, especially in the drain valves. Naturally, they are more expensive. On the bottles they perform just like the evil black ones if you get close on the durometer.

BTW, if you can't afford teflon-coated springs internally, try silicone surgical tubing on the smaller (5L and down) bottles (~5L and down). Short life, but relatively cheap and readily available.

Thanks for the information. At last, actual data.

Marc

Marc Willis
SIKULIAQ Shipyard Project Office
Marine Science Technical Director

Reply from David Forcucci on Wed, 1 Dec 2010

For Healy we give these choices of o-ring on our cruise planning form.

O-Ring type:

Silicone Nitrile Buna-N VITON

Last season on cruise went with Nitrile, the others chose Silicone.

Dave

David Forcucci

Healy Marine Science Coordinator

1519 Alaskan Way S

Seattle, WA 98134

On 12/1/2010 13:26, William Smethie wrote:

I have used both Buna N and Viton O-rings for CFC and SF6 measurements and found both to be good. We routinely bake new O-rings at about 60°C in a vacuum oven for 2-3 days to remove any CFCs or SF6 that may have adsorbed or absorbed by the O-rings before installing them on sample bottles. We avoid using any grease on the O-rings, since the grease will absorb CFCs from the air and then release the CFCs to the water sample.

Bill Smethie

Reply from: Andrew Woogen (MLML) on Tue, 7 Dec 2010

Thank you for all the good responses on this subject.

I was able to touch base with one of the scientists who informed me of the Buna-N problems.

Here is a brief summary:

J. Timothy Pennington, Ph.D and Blum, Marguerite at MBARI conducted a study to insure an AUV-Gulper can collect phytoplankton growth.

MBARI created a device that collects water samples inside an oscillating AUV called a Gulper.

Water samples taken by the AUV-Gulper were compared to samples from a reliable CTD rosette at the same time/location. Something was affecting phytoplankton growth in the AUV-Gulper water samples.

After a series of troubleshooting techniques each material from the AUV-Gulper was placed in a separate incubation jar.

The incubation jars with Buna-N negatively affected phytoplankton growth the most.

This study was never published but I've attached a few slides from the study.

I hope this helps the RVTECH knowledge pool,

Andrew