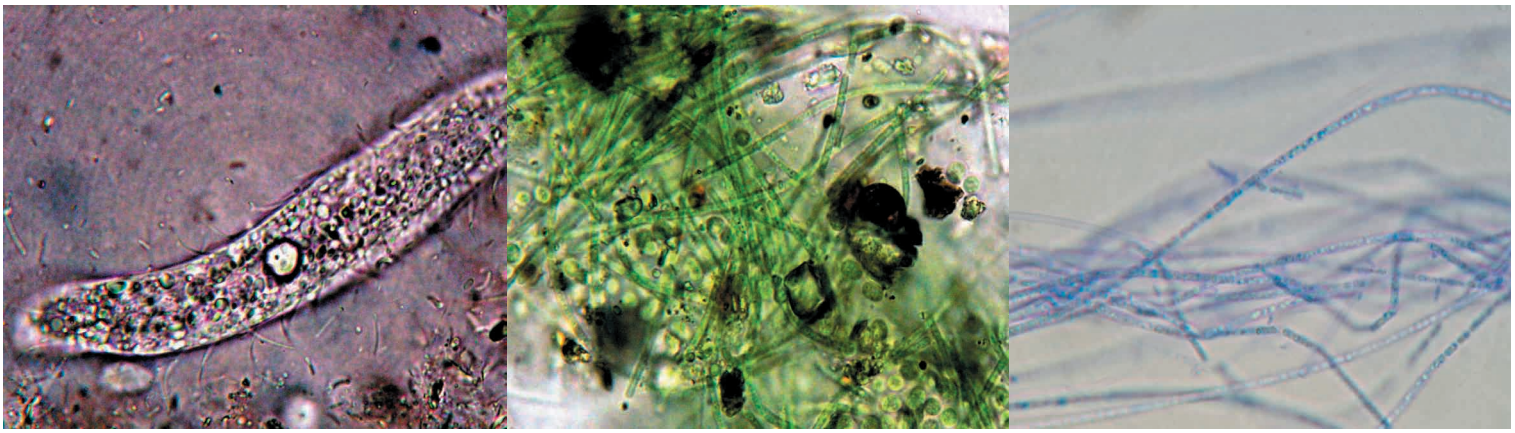

TECH TIPS

Issue #17 June 2007

Foaming and Bulking in Microbiology

JohnsonDiversey
Account Managers are being asked
by customers what is this "stuff"
in my closed loop system and how do we get rid of it?
Why are the screens/nozzles getting clogged?
OK now, what is a closed loop system?
A closed loop system is a self-contained unit with water used for heat exchange. An example of a closed loop system would be a cooling tower, beverage warmer or a brewery pasteurizer.
Water does not escape from a closed loop system.
Why am I having foaming problems?
What is the stuff floating at the top of my well?
It seems these questions are popping up much more frequently in conversations, and the answer may be microbial contamination.

There are two prevalent types of problems with a closed loop system: Bulking and Foaming.

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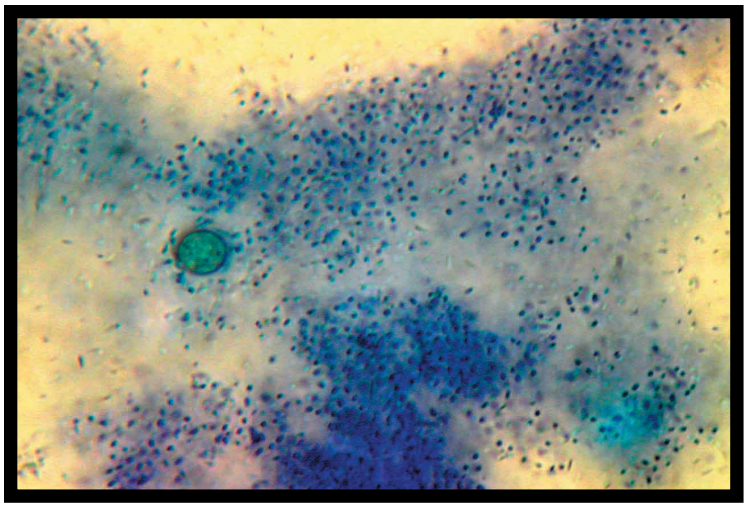
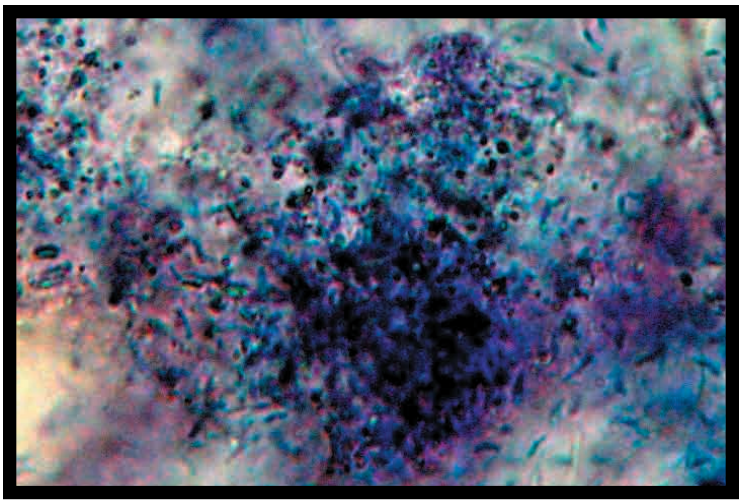
Bulking

Bulking is when too much macrostructure (the external form of a structure that can be observed without magnification) is present in the system. The macrostructure may be referred to as "floc" or "particulates". The accumulation of any type of macrostructure interferes with the compaction and settling of the system. Bulking can be caused either by filamentous organisms or by non-filamentous organisms.

Non-filamentous bulking (in example, slime) consists mostly of biofilm. Biofilm is layers upon layers of microorganisms that are protected within an adhesive matrix. Adhesion is made possible by EPS. EPS is an abbreviation for either exopolysaccharides or extra polymeric substances. The biofilm mass will retain water, making a slimy, wet, jelly like structure.



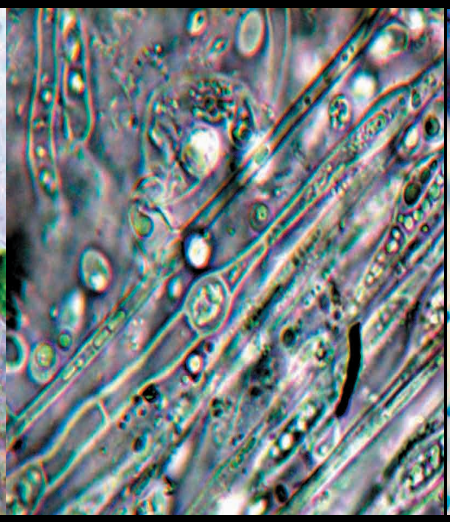
Bacterial biofilm stained blue:
1,000 X magnification



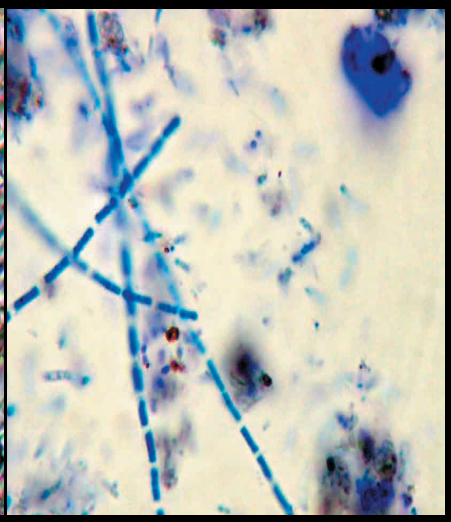
Bacterial biofilm and
unidentifiable organic material stained blue:
1,000 X magnification

Filamentous bulking is when large branching structures of bacteria, algae (rare in most instances), or fungi cause clogging of lines.
A real life example would be similar to a drain being clogged by hair.

Filamentous algae and
organic debris:
1,000 X magnification

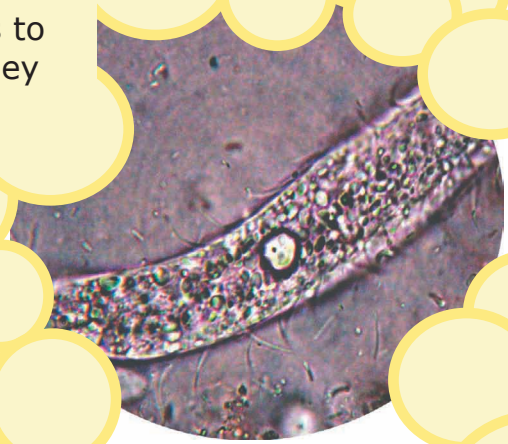


Filamentous fungi:
1,000 X magnification

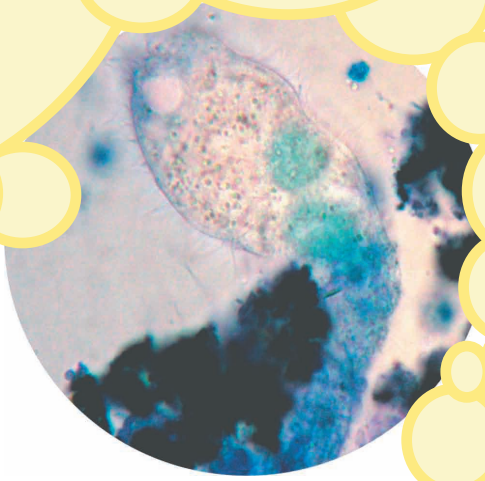


Filamentous bacteria
stained blue:
1,000 X magnification

Foaming
Foaming occurs when surfaces that are hydrophobic (the condition of repelling water) grow in sufficient numbers and make surrounding particles/floc hydrophobic and allow the particles to attach to air bubbles. Since the air bubbles are less dense, they float to the surface and stay. When a large amount of these particles float to the top it is known as "scum".



Ciliated protozoa from cooling tower sample: 1,000 X magnification



Ciliated protozoa found in foam floating in well: 1,000 X magnification

How can I tell if the problem in my system is microbial?
The best way is to determine if your problem is microbial is to pull a sample (using aseptic technique) and send it to the Microbiological Services Laboratories for a microscopic examination. It is best to send the sample as quickly as possible via overnight courier (i.e. FedEx, UPS, etc.). Refrigerate all samples before shipment if not sent right away to the laboratory. The sample may be a liquid sample, a scraping of the slime, or as much "scum" as could be skimmed and placed into a container. Since the goal is to maintain microbial integrity, it would be best practice to keep the sample cool during shipment using re-freezable ice bricks.

What if the problem isn't microbial?
Bulking may occur from corrosion taking place in the system due to inadequate treatment. Floc/particulates present may be mostly iron oxide or other metal oxides. This type of corrosion happens in mild steel lines, copper heat exchangers, and PVC piping.

What is aseptic technique?
Aseptic technique is the technique used to keep samples from being contaminated with the extraneous surrounding microorganisms. This means the use of sterile containers (either bottles or whirl-paks), not touching the openings of the containers with your hands, or the practice of laying lids down onto environmental surfaces (floors, tables, etc) before using lids to secure containers.

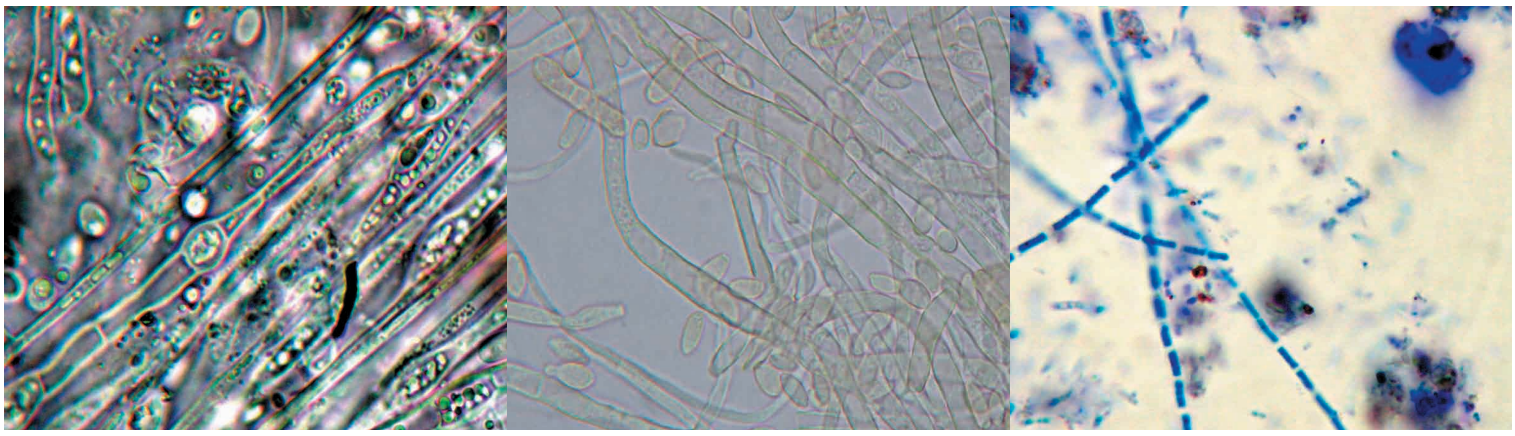
You may not have a sterile container with you when you decide to sample. You may substitute zippered sandwich bags in a pinch. For liquid samples, it is possible to use a bottle that had been rinsed with 70 % isopropyl alcohol and allowed to dry prior to filling.

You have determined that the sample(s) I sent are microbial, now what?
Once a determination of the cause of the problem is made, the best treatment prescribed is a sodium hypochlorite sanitizer such as **Dibac** to help regain microbial control in the system. It is best to pair **Dibac** with a wetting agent such as **Tendec** in order to help the sodium hypochlorite to penetrate the macrostructure membranes more effectively.

However, since chlorine is also an oxidizing agent and other chemicals present may be reducing agents, a relatively large amount of chlorine (a slug dose) may be needed to initially treat the system. Once chemical control has been achieved, you may start maintenance of the system with a non-oxidizing microbiocide.

For industrial applications (cooling towers, etc.), the best treatment is the addition of a microbiocide to the closed loop. Oxidizers are not recommended due to the interference with corrosion inhibitors already added to the system. A standard practice is that after the addition of five to ten biocide doses to a closed loop, the loop is drained and cleaned in order to minimize foaming due to the breakdown products associated with the chemicals added and the microorganisms present.

For specific product recommendations, please consult your JohnsonDiversey Account Manager.



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