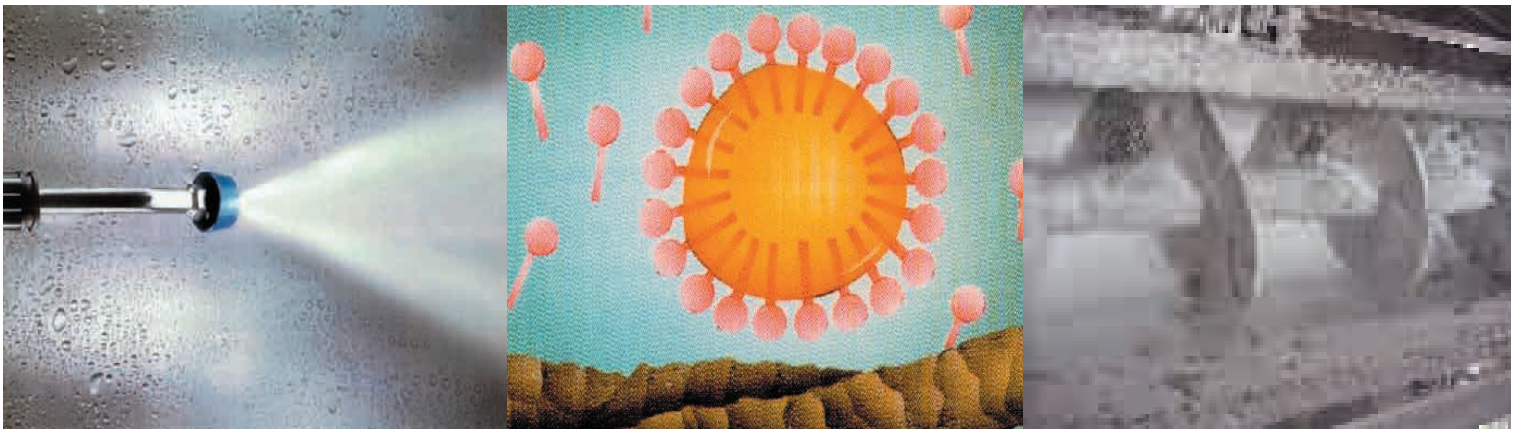

TECH TIPS

Issue #13 January 2007

Common Soils Encountered in Food Processing

Soil

What is it? The best definition for soil is simply, 'matter out of place'. Soil is unwanted matter on a surface of an object that needs to be clean. So, what's the problem with soil remaining on food processing equipment? Microorganisms! Microorganisms are the primary reason for product shelf-life issues. Soils are nutrient sources for microorganisms. Eliminate the soil and product shelf-life issues can be reduced. It's as simple as that.

Soils are best identified by characteristics that provide information on how they may be solubilized. Visible soil is classified according to their solubility in:

- Water
- Alkali
- Acid
- Surfactant solution
- Or, none of the above

Soils, such as sugar and some inorganic compounds can be dissolved and washed away with water. Additionally, the greater part of food soil can usually be suspended in water and simply removed by the force of a water spray. Any soil that is not directly soluble in water and is not removed with water pressure will be left behind as a deposit or film. Most films are tightly bonded to surfaces so that even high pressure water (400 psi) will not remove them. Ergo, enter the detergent. The purpose of a detergent is to chemically interact with the film and remove it: This can be either through a chemical or a physical reaction.

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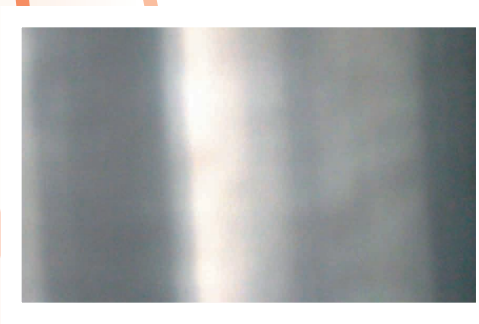
Soils can be better understood by examining their composition and what detergents remove them. Below is a characterization of common soils found in the food processing industries:

Protein Soils
Proteins are long chains of different amino acids. All amino acids contain carbon nitrogen bonds (C-N). Protein soils from milk, eggs, and meat can be solubilized and removed from a surface by a chlorinated alkaline detergent. How does a chlorinated alkaline detergent remove a protein film from a surface? Chlorinated alkaline detergents contain sodium hypochlorite (NaOCl). NaOCl is an oxidizer which chemically reacts with the C-N bond; it breaks the protein apart and solubilizes the components. Below are two photos, one showing a protein film and the other after cleaning with a chlorinated alkaline detergent.

Protein film remains on a surface due to inadequate cleaning

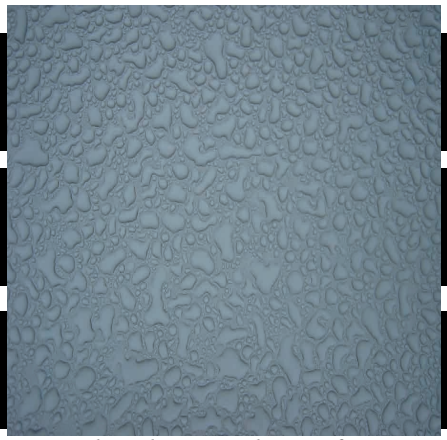


After proper cleaning, the protein film is removed

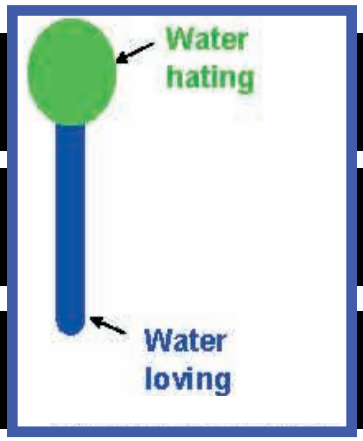
Mineral Deposits
Depending on the process, mineral deposits will take various forms and have names such as beerstone, milkstone or waterstone. The composition of these deposits will vary. Some, such as waterstone or hard water scale, are simply the chemical compound calcium carbonate ($CaCO_3$). $CaCO_3$ can be very quickly removed with an acid detergent. Others are more complex matrixes of organics and minerals that may require a wash with a strong chelant or alternating both alkali and acid detergent washes.

Fats and Natural Oils
Fat from animal sources such as milk, poultry or other meats quickly adhere to surfaces. Natural oils, such as terpenes, that impart flavor to beverages, also adhere to surfaces and act much like fats. Fats are triglycerides and caustic (NaOH) will chemically break them apart. A hot caustic based detergent is the best for removing fats and natural oils. If at all possible, clean above the melting point of the fat or oil as this will greatly enhance removal. Generally this temperature is above 120 ºF (49 ºC).

At this time, we should ask: "Visibly, how do I know if a surface clean?" Sometimes we can not see surface film but we can see evidence that it is present. Beaded water on a surface is usually proof that a surface film is present and that the surface is not clean. If water sheets evenly from the surface, or a 'water break free surface' is present, then the surface is clean. Below are two photos that illustrate the point.



Water beading on the surface is evidence of a hidden surface film



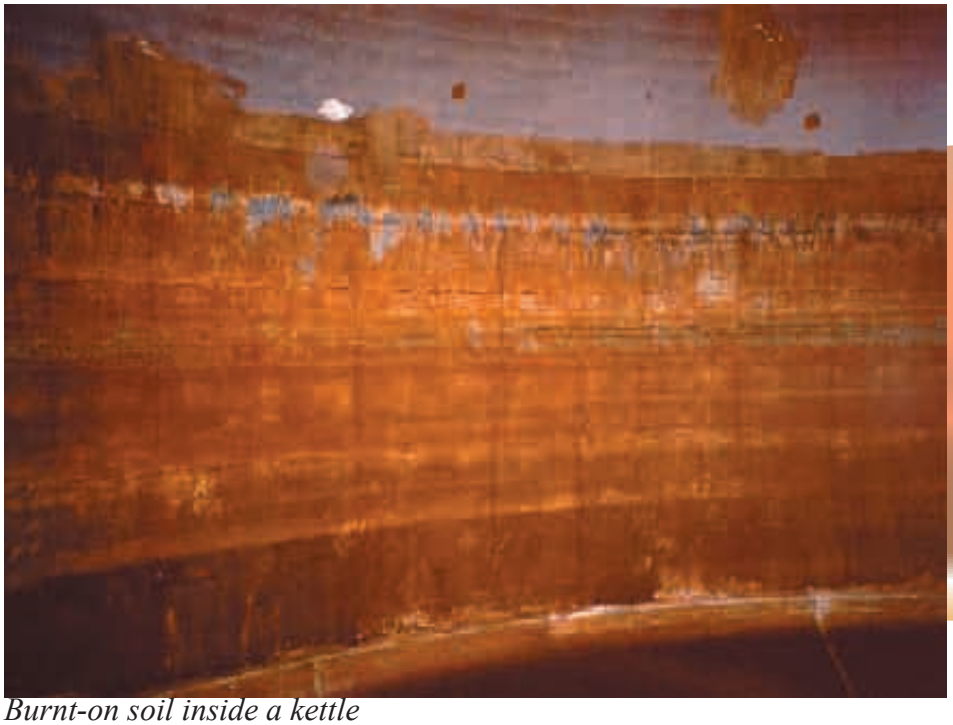
Surfactant Molecules

A water break free surface is a quick check on whether a surface is clean

Lubricating Greases and Oils
Lubricating greases and oils will not be solubilized by either acids or alkali. They can be melted by hot water or steam but usually a thin film is left behind. Surfactants are surface active compounds which help emulsify greases and oils. Detergents built with surfactants will break greases and oils into small globules which are soluble in water or can be suspended in water. Most dust and dirt contain some oily material which makes using a detergent formulated with surfactants the best choice.

There are two other factors that are important in soil deposition and removal:

Heat
Many processes in the food industry require heat; for example pasteurization, cooking or frying. Soils that are heat set (formed on a heated surface) are usually more difficult to remove than soils that are cold set (formed a on a surface a room temperature or lower). The reason for this is heat denatures and chemically decomposes the soil. A heat set soil has lost some its 'chemical handles' and does not quickly react with acid or alkaline detergents. More aggressive cleaning is usually required to remove heat set soils.



Burnt-on soil inside a kettle

Surface Irregularities
The condition or roughness of the surface will influence soil deposition. Compared to a smooth surface, unevenness and surface irregularities offers niches for soil deposits. To illustrate this, below is a picture taken inside a dairy silo. There appear to be erratic patches of soil. Upon further analysis, what was discovered was the surface of where the soil was present was rougher than the surrounding area. Compounding this, the cleaning program was marginal. Consequently, what happened was that the soil would not adhere on the smooth areas but the rough surface provided sites for deposition.

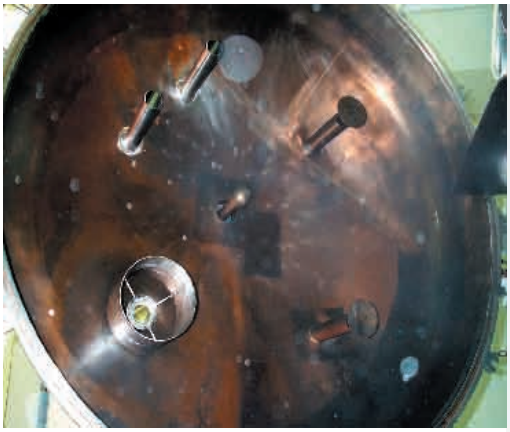
Table of Films and Deposits
A well designed sanitation program should be trouble free. However, any given system may have flaws. As examples, part of the cleaning procedure may have been omitted; or equipment may not have been function properly; or the water characteristics may have changed. Any of these factors may lead to the formation of a film or deposit. The attached table provides a summary of films and deposits, their probable causes and methods of removal. (In the table, specific chemical names are not mentioned. If recommendations are required, please consult your JohnsonDiversey Account Manager.)

The most critical prerequisite in sanitation is knowledge. It is only through knowledge that we can understand the systems, processes and mechanisms that cause a problem and then be able to solve them. Understanding soils, their properties and what removes them will not only help us resolve problems but help us provide a safer product to our customers.

Uneven deposition of soil due to surface irregularities

Descriptive Table of Films and Deposits

Film or Deposit	Description	Probable Causes	Procedure for Removal
Protein	A blue or rainbow colored film having a varnish like appearance	1) Use of a non-chlorinated detergent 2) Inadequate pre-rinse 3) Intermittent cleaning	Use a chlorinated detergent at sufficient strength as to maintain 60 PPM available chlorine throughout the wash.
Fat or Grease (animal Origin)	A greasy, oily sometimes white film on which water will form into beads	1) Low wash temperature (most common) 2) Inadequate/low concentration of detergent	Wash with a hot alkaline solution.
Oil or Grease (Hydrocarbon)	Black and/or greasy film	1) Oil and dirt from manufacturing 2) Over greasing of equipment	Wash and brush with hot foaming alkaline detergent.
Carbohydrates (Sugars and Starches)	Clear to brown sticky films	1) Inadequate pre-rinse 2) Intermittent cleaning	Wash with a hot alkaline detergent. Check sanitation program.
Mineral Deposits	White, grey or yellowish deposits, sometimes gritty	1) Minerals settling out of water 2) Minerals reacting with substances in beer, milk or meat and then settling out	Either wash with an acid detergent or wash with a detergent contain a strong chelant. Alternating acid and alkaline washes may be required.
Surfactant Film	Blue film	1) Poor rinsing of detergent 2) Overuse of detergent	Wash and insure rinse is adequate (all foam is gone). Check concentration.
Gasket (Rubber Film)	Black streaks which at times may be sticky	1) Aged gaskets 2) Overuse of chlorine sanitizer	Wash with an acid detergent and change gaskets.
Food Stabilizer Films (Gums and Esters)	White, sometimes streaky film	1) Inadequate pre-rinse 2) Improper detergent selection	Wash with hot alkaline, surfactant detergent.
Iron Deposits	A red, brown or black film	1) High iron in water supply 2) Low pH of incoming water 3) Iron corrosion issues	Wash with an acid detergent and address source of iron.
Silica Films	White or grey glaze on equipment	1) Silica from incoming water (most common) 2) Poor cleaning	Consult JD Account Manager, need to clean with special acid.
Etching	Pitting, usually with white deposits on and within pits	1) Improper use of chemicals 2) Aggressive water (Consult JD Account Manager)	Repolish and passivate surface.



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