

Basic knowledge of stains:

Introduction:

Stainless steel and aluminium are well-known for their high chemical and corrosion resistance in comparison to other metals. However, it is not maintenance-free, since contamination from the environment can still occur, causing stains. However, there is a misconception between stains and corrosion. This document is designed to provide an explanation and guidance on the most commonly found stains on the surface of coated stainless-steel mesh products.

What are Stains:

Brownish/Redish/White/Tea Staining on the coated surface of Stainless-Steel Mesh is an accumulation of dust, oil, liquid chemicals or airborne particles that have attached to the surface, and without washing, removing, or cleaning have reacted with a small amount of water, moisture, or humidity. Mentioned sources will cause different coloured stains.

How do stains happen?

- a) Contaminated by corrosive substances – On the surface of uncoated or coated stainless steel, sea salt causes the surface of the stainless steel to remain wet in high humidity environments for longer.
- b) Atmospheric conditions – When there is a combination of atmospheric conditions and high humidity, the high humidity creates a layer of moisture on the stainless steel, which dissolves the salt and creates a corrosive spot on the surface of the metal.
- c) Surface shape – Any cross-section or uneven surface that can trap salt, dust particles or moisture will be more susceptible to tea staining and corrosion.
- d) Organic compounds - It can also be caused by organic compounds (food, dust, pet urine) reacting with strong cleaning solutions (bleach, car wash, floor or dish cleaner).
- e) Lack of regular maintenance – Stainless steel isn't 100% maintenance-free. However, simply rinsing off your stainless steel products regularly with fresh water can help to remove any corrosives such as salt, dust particles and harsh chemicals on the surface.

Mechanism:

The main mechanism of tea stains is complicated and not yet clear. Theoretically it is involved with the negative ions (such as Cl^-) interacting with contaminations (organic compounds such as hydroxy compound, carboxylic acid) on the grain line of the coating surface. The failure mechanism starts from outside of the product then grows into the product as shown in figure 1.

Formation of failure start from "outside to inside"

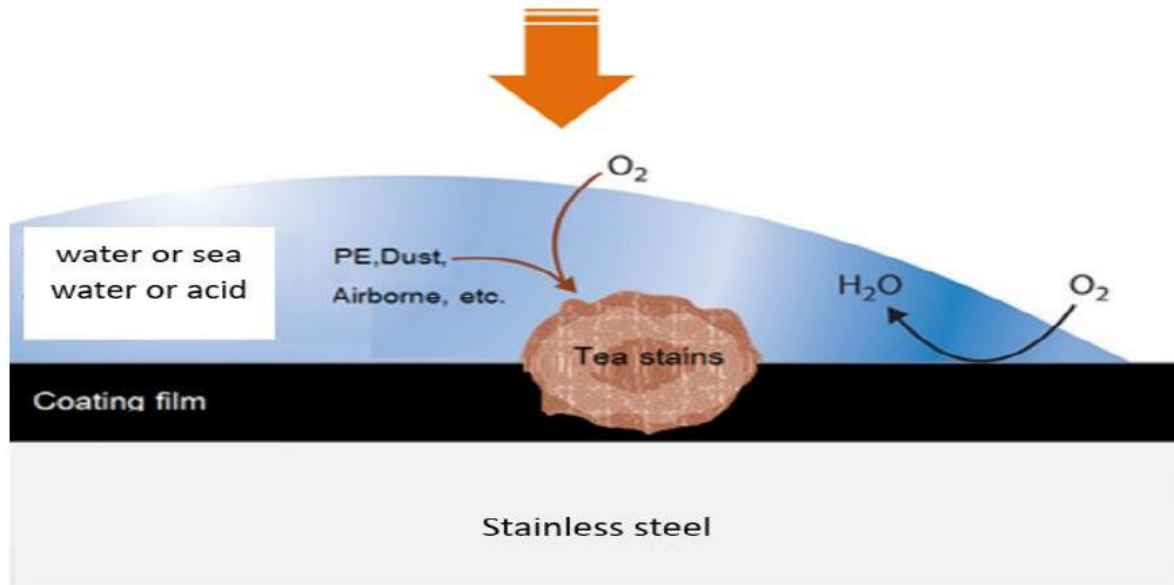


Figure 1.

What causes the stains?

Using FTIR (Fourier-transform infrared spectroscopy) methodology is a useful scientific technique to analyse the composition to verify or distinguish an unknown component. The composition breakdown of tea stains and rust are summarised in table 1.

Sample	Possible main chemicals	Example of applications
Tea stains	Carboxylic acid & hydroxy compound	Organic compound; ants, vinegar, food, drinks, urine, bleaches, etc.
	Coal	Coal
	Cellulose	Organic compound; paper, paperboard, biofuels, cotton, etc.
	Metal oxide	Metal oxides are crystalline solids that contain a metal cation and an oxide anion. They typically react with water to form

Table.1

Remark: The possible main chemicals tabulated above have been collected from hundreds of samples and tested by accredited laboratories from various universities.

Consequence:

Even though tea stains only make the surface undesirable at the beginning phase, it is worth mentioning that if tea stains are left unattended for a certain period, the failure will eventually grow deep into the product and corrode the metal, leading to affecting the product’s lifetime. Therefore, it is important to remove it as soon as possible. Tea staining is not considered a manufacturing fault, but a failure to maintain the product correctly, and is not covered by warranty.

How to prevent tea staining:

Here are some methods that can be followed to prevent tea staining:

Do	Don't
<ul style="list-style-type: none"> • Follow cleaning instructions provided by manufacturer by: <ul style="list-style-type: none"> ○ Wipe out dust particles regularly with damp cloth. ○ Cleaning regularly at least monthly with liquid soap/shampoo or very mild detergent only. ○ Clean stainless-steel ware as soon as it's dirty. • Be aware of the chemicals that will be in contact with stainless-steel ware. If possible, avoid chemical products such as strong detergent, harsh air refresher gel, furniture cleaning wax, etc. 	<ul style="list-style-type: none"> • Cleaning with harsh chemicals/solvent (floor cleaner, dish cleaner, etc.) • Cleaning with strong or abrasive brush, metal brush. • Cleaning with chemicals powder (baking soda, aluminum powder, etc.) • Damaging surface by scratching, hard polishing or rubbing with metal.

NOTE: This document is developed by Meshtec International Co., Ltd. Intended to conclude testing of samples collected from various sources.