

New, inexpensive procedure provides first-class results even when conducted by oneself:

DEROUGING OF STAINLESS STEEL EVEN WITHOUT USE OF AGGRESSIVE MEDIA

In the food and pharmaceuticals industry it is common practice for systems to be made from stainless steel. Indeed, steel does behave passively towards many media but is not completely inert; even the passive layer of a stainless steel surface "ages". It forms a rust-coloured coating, so-called rouging. Its visual appearance is unattractive and in terms of safe process management is unacceptable owing to the release of foreign particles. The only remedy is to intensively clean the material surface using chemicals in order to remove the rouge layer with its high iron oxide content and to subsequently create a new passive layer with chromium oxide. Specialist companies previously removed this iron-oxide coating by using powerful, acid cleaning solutions. Now, a new concept has been developed using a pH neutral cleaning solution, leading to first-class results and which can even be implemented by the user himself providing he follows the instructions for use.

In chemical terms, stainless steel is an iron-based alloy containing at least 11 % chromium. To prevent the material being attacked by the atmosphere, an ultra-thin, protective layer with a rich chromium-oxide content is formed on its surface. In its everyday use, this thin protective layer is constantly exposed to a variety of influences, particularly in the pharmaceutical sterile production sector. Chrome is depleted; the remaining iron-rich layer turns rust-coloured caused by the remaining iron oxide. The only remedy previously available was to use powerful, acid, cleaning agents (for example, phosphoric/sulphuric acid mixtures with an acid content of partially > 30%) with aggressive additives. It was necessary to dispose of the remaining solution as hazardous waste. Ateco Services AG Rheinfelden now offers a chemical procedure which does not use aggressive chemicals and which can return systems parts or containers, even those heavily affected by rouging, back into a condition which is as good as new.

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The new agent allows both flooding and spraying processes and circulation through the pipes. Autoclaves can be cleaned quickly and safely. 1a) autoclave before cleaning, 1b) autoclave three months after derouging, still perfect surface through the newly created passive layer.

Gently but thorough cleaning

You do not always need to bring out the heavy artillery to achieve top-class results and chemistry, in particular, is a prime example of this. Modern production procedures are increasingly forgoing the use of caustic, acidic or similarly hazardous substances. Catalysts in the form of chelating agents speed up reactions and often even allow an improved outcome through a targeted reaction. This approach has now been transferred to derouging. The new procedure is based on two steps using different chemical formulations. The reagents

are supplied in concentrated form and are diluted with purified water on site. In the process, the concentration of ready-to-use solution can be adjusted by varying the amount of concentrate added according to the degree of rouge present. This cuts costs and helps protect the environment. Derouging and passivation solutions can be used in immersion and flooding procedures as well as in spraying processes. This means that beside the known applications for cleaning pipe systems, even autoclaves (image 1a,b), batch, production and storage tanks (image 2a,b) or even freeze-drying systems (image 3a,b) can be effortlessly cleaned. Frank Zimmermann, Deputy Pharma Production Plant Manager, said "We use a variety of different stainless steel systems in our production such as WFI-Loop (Water for Injection), clean steam distribution systems, autoclaves and washing machines. We have signed a service contract with Ateco which helps us to optimally maintain our systems and to comply with the relevant health regulations regarding stainless steel surfaces. The new pH neutral procedure which has been used here brings us first-class results". Unopened containers with the concentrate can be stored over a long period which means that a derouging treatment can be carried out at short notice as required without having to contract in an outside company. Operating procedures and ongoing productions remain unaffected.



Both immersion and spray processes are suitable for storage containers and achieve a highly polished, passive surface. The two

images show the inner surface of a storage container before (2a) and after (2b) derouging.

In practice

The containers of derouging concentrate can be stored unopened for up to two years. Depending on the size of container and the amount of soiling, the concentration is well mixed in the system to be treated using 75 to 85 °C hot, demineralised water. There are two sets of container available with the appropriate Diruneutra concentrate for 250 l or 1,000 l derouging solution. Normally, a standard set is sufficient to produce the appropriate amount of ready-to-use solution, if necessary, the concentration can be increased by up to four times the amount. Should the container to be cleaned be derouged using the spray method, for example via a CIP system, then it is must be rendered inert with nitrogen to a residual oxygen content of less than 0.5 % before adding the activator powder. The solution can now be moved through the system using spray nozzles, circulation pumps or agitators. Only the system parts wetted by the solution are cleaned. The derouging process takes between 30 and 240 minutes, depending upon temperature and thickness of the coating to be removed. Reaction can be examined by periodically testing. Once the exposure time has finished or following a positive test result, the prescribed amount of Diruclean NS is added and mixed with the pH neutral solution. Neutralisation is no longer necessary through this method. After approximately 45 minutes of rotation or circulation, the pH neutral residual solution can be emptied into the in-house waste water system. The container surfaces or piping systems should then be flushed through for at least five minutes with either hot or cold running water. The subsequent bare metal stainless steel surface still requires a controlled renewal of the passive layer rich in chromium oxide.

In order to do this, the system is filled with cold, demineralised water (< 30 °C) and Dirupass NB concentrate is added in the prescribed amount (3.5 %). Neutralisation is not necessary. All the surfaces to be passivated must now be continually wetted with the solution for at least 45 minutes. The pH neutral solution is then also emptied into the waste water system; the system itself is flushed through with running water for five minutes. A final test for measuring conductivity is performed. The procedure is finished once a difference between input and output conductivity of the rinse water is less than 1.0 µS/cm.



Freeze drying systems are usually somewhat larger. The spray process is particularly suitable in order to balance costs against benefits. Here is an example of an adjustment plate before (3a) and after (3b) derouging.

The new Diruneutra derouging procedure offers the user several advantages: firstly, no aggressive chemicals with disposal regulations are used; secondly, the concentrates can be obtained in advance for targeted use as required. This means that its usage can be selectively put in place when production is paused without disturbing schedules. As it is possible to perform the work oneself and disposal costs are considerably lower, this new procedure saves money.



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