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IKW Recommendation for the Quality Assessment of the Product Performance of Degreasing Power Cleaners (2017)

German Cosmetic, Toiletry, Perfumery and
Detergent Association (IKW)

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Translation/Original: German

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1. Foreword

1.1 Remit

IKW member companies and test institutes make their expert knowledge of the products they manufacture available to the general public; this is done in the form of quality assessment recommendations. These are intended to enable a qualified testing of the cleaning and maintenance products by the manufacturers themselves and by test institutes. Quality characteristics are described that need to be fulfilled by the products concerned in order to achieve the effects expected by consumers and manufacturers.

1.2 Sustainability

Companies working within the framework of the IKW want optimal quality standards for their products. Their aim is a consistent orientation to sustainability as a guiding principle, preparing to successfully face the future in a constantly changing world.

This commitment to sustainability as a guiding principle is built up on experiences expressed in numerous exemplary initiatives. Taking as starting points the Declaration of Rio 1992, "92+10" of Johannesburg and the Agenda 21, sustainability is understood as a balanced linking of economic, social and ecological aspects, with a view to meeting the needs of the present without compromising the ability of future generations to meet their own needs. With this in mind, quality assessment recommendations help to encourage company staff to act responsibly toward humans and the environment in product development and manufacture. They also serve consumers who can expect efficient, safe and environmentally sound products.

1.3 Assessment of Test Results

The recommendations describe which qualities are relevant to a given product and how such qualities can be measured. It should be noted that every finished product has a certain efficacy spectrum in its intended use; this spectrum is largely determined by consumer expectations as to each individual quality characteristic – so that in each product some characteristics are deliberately emphasized while others will be less important. Moreover the desired combination of product

properties is subject to constant change, depending on the latest technical possibilities and new consumer habits.

Quality assessment recommendations must not impair such developments. Consequently for each product only one overall result is valid to determine whether the product meets the quality recommendations or not. Emphasis on isolated test criteria is not admissible and may be misleading.

1.4 Requirements

With regard to composition, packaging and labelling, inter alia, the following statutory requirements must be observed in their existing versions or to the extent that they still apply, respectively:

- German code on foodstuffs, consumer items and animal feed (Lebensmittel-, Bedarfsgegenstände- und Futtermittelgesetzbuch – LFGB)
- German chemicals act (Chemikaliengesetz – ChemG)
- German dangerous substances ordinance (Gefahrstoffverordnung – GefStoffV)
- German detergents and cleaning products act (Wasch- und Reinigungsmittelgesetz – WRMG)
- Detergents Regulation (EC) No 648/2004
- Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures ("CLP")
- Regulation (EC) No 1907/2006 on registration, evaluation, authorisation and restriction of chemical substances ("REACH")
- Regulation (EU) No 528/2012 concerning the making available on the market and use of biocidal products
- German ordinance on pre-packaged products (Fertigverpackungsverordnung – FPV)
- German ordinance on the transport of dangerous goods by road (Gefahrgutverordnung Straße – GGVS)
- German ordinance on the transport of dangerous goods by rail (Gefahrgutverordnung Eisenbahn – GGVE)

1.5 Voluntary Agreements

- Ban of chlorinated organic solvents, from 1 January 1988
- Ban of musk xylene, from 31 December 1993

- Ban of alkyl phenol ethoxylates (APEO), from 14 January 1986
- Ban of EDTA
- Ban of Triclosan

2. Introduction

Degreasing Power Cleaners are intended to be used in households for cleaning areas with greasy soils, e. g. kitchens. They are not intended for cleaning vehicles and accessories for vehicles including protective helmets.

Normally, the concentrated products are used for cleaning surfaces.

Degreasing Power Cleaners are preparations consisting of various surfactant mixtures, water soluble solvents and complexing agents. They also contain additives such as perfumes and colourants as well as preservation auxiliaries. Formulations are available as standard products and/or concentrates. Usually, formulations are alkaline. This recommendation are for such products. Consequently for the quality assessment of such widely marketed and much observed products a straightforward, reproducible and practice-orientated test method is desirable, both in external comparative testing and in product development.

For developing such a method, a working group composed of experts from companies manufacturing cleaning agents and from test institutes was constituted within the German Cosmetic, Toiletry, Perfumery and Detergent Association (IKW).

3. Aim

The mandate of the working group was to develop an IKW recommendation for the quality assessment of the product performance of Degreasing Power Cleaners, in addition to the recommendation for the quality assessment of all-purpose cleaners dating back to the year 2014 (I). The recommendation wants to enable qualified testing of the products by the manufacturers themselves and by independent test institutes. The update needs to meet the following criteria:

- Practice relevance
- Reproducibility
- Differentiation between products
- Straightforward implementation, to the highest degree possible

4. Strategy Followed by the Working Group

4.1 Product Performance: Cleaning Performance

The methods, as described in the recommendation for the quality assessment of the product performance of all-purpose cleaners of 2014 (I) are unsuitable for power cleaners intended to remove grease. For this reason, this recommendation is elaborated specifically for those products.

4.2 Product Performance: Material Care

The evaluation of material care continues to rely on the stress cracking corrosion test with small plastic sticks made of different materials, based on German standard DIN 53449-3 [Testing of plastics; evaluation of environmental stress cracking (ESC); bent strip method] (II).

5. Testing Principle

The product performance is determined by way of the following measured data:

- Cleaning performance
- Material care

For further characterisation, the pH value is determined without assessment.

6. Description of Method

This method is suitable for differentiating between special kitchen and grease power cleaners. The influence of the viscosity of products was not tested when this method was developed.

6.1 Cleaning Performance of the Concentrated Product

6.1.1 Scope of the Test Method

This test method covers the evaluation of the cleaning performance of hard surface cleaners on tough polymerized grease baked on stainless steel plates. The grease test method is actually mimicking the removal of cooked or baked-on grease.

When cooking at home, hot and partly polymerised oils and fats are ejected onto kitchen surfaces, particularly on the cooker top. During the action of cooking, the cooker surface becomes hot. This additional heating makes the greasy soil harder due to increased levels of polymerisation to eventually form a tough greasy soil. A common cleaning habit is to clean this type of pure grease, when found on hard surfaces, upon direct application (i.e. scrubbing).

6.1.2 Test Method Overview

A greasy soil is laid down onto stainless steel tile and then baked and aged prior to be used for the cleaning assessment.

A scrubbing device is used to mimic the scrubbing process as done by the consumer in-home when using the product on tough soil. The number of strokes reached to fully clean up the grease baked soil highlights the performance of the cleaner. Statistical analysis (e.g. Tukey's test) is performed with 95% confidence level to determine the significant differences among the detergents.

6.1.3 Equipment and Materials

(See **Appendix A** for overall specifications)

Sheen PG 903 scrubber (Supply Source 1)

Analytical Balance (0,01 grams accuracy)

Stainless steel tile

Painting Roller.

Oven (e. g. Memmert UFE 600)

Metal Box for baking process (optional)

Soil Ingredient List and Detergent

(See **Appendix B** for overall specifications)

Peanut oil

Sunflower oil

Corn oil

HSW soil

Optional colourant

Cleaner for tile cleaning after testing

6.1.4 Pre-treatment of Tiles and Sponges

Pre-treatment of Stainless Steel Tiles

Each new tile must be pre-treated upon reception. Pre-treatment consist in multiple soiling and baking steps upfront being usable for testing. Pre-treatment is done as follow:

- Remove the plastic foil from the stainless steel tile; this is the test side of the surface.
- New branded tiles are soiled and baked as described in section 6.1.5.
- Soiled tiles are hand cleaned right after baking process with neat cleaner (see **Appendix B** for details) after they have cooled down. Tiles are soaked at least 30 min into the cleaner before being gently hand rubbed with a sponge.
- Steps b and c are repeated 2 times, so that a total of 3 soiling and baking steps are carried out on each tile

e) Rinse out the tiles with demineralised water and dry them with a terry towel

f) Wipe the tiles with ethanol to leave them out of any residues

Note: Stainless steel tiles are not recommended to be used more than 10 times (excluding pre-treatment) for testing as any scratches can cause local spots of harder polymerization and influence the variance of the testing.

Sponge

Sponges have to be washed out 3 times in a household washing machine at 95 °C before being used for testing. No detergent is required. A white/color cycle (approx. 90 min) is used with high water level.

6.1.5 Soil Making Process

Weight 50 g of each oil (peanut, sunflower and corn oil) and mix them up into a beaker.

Pour into a 50 mL beaker:

19,6 g of the oil mix (98%),

0,40 g of "HSW soil" (2%),

optional colouring agent, e. g.

0.02 % -0.04 % of Lumogen F Rot 305 (BASF)

or 0.1 % Carbon black (Spezialschwarz 4), e. g. Evonik

Stir the blend at least 15 min at 1400 rpm before using the test soil.

6.1.5.1 Soil Application

8 tiles are soiled par batch of test soil.

Clean up the tiles with ethanol (i.e. spray and wipe).

Place the 8 tiles "edge to edge" on top of the Aluminium foil. Weight each tile and write it down on the Aluminium foil right below the tile.

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Painting rollers need to be pre-soiled by rolling on a surface with approx. 10 mL of test soil. Put 2 mL of the test soil on each tile within a pipette.

Roll out homogeneously the test soil with the painting roller across the tiles (25 cm x 8 cm); do vertical first, then horizontal and finish by horizontal strokes.

Weight again each tile and check out the soil deposit (total weight of soil per tile should be equal to $0,6 \text{ g} \pm 0,05 \text{ g}$).

If the soil weight is not in this range, then repeat the rolling process until getting the right weight.

6.1.5.2 Soil Baking

Remove all the trays from the oven, except the last 2 trays at the bottom of the oven.

Optional to protect the soil from the air-flow of the fan: Place the metal box in such a way that plates do not face the air flow (see [Appendix A](#) for metal box specification). If no metal box is used, then the power of the fan shall be reduced or the distance between plates and fan shall be increased.

Make sure that the oven is in a perfect horizontal position. Close the oven and pre-heat the oven at 150°C .

Ensure the fan of the oven is set up to its maximum position if a metal box is used.

When the pre-heating target temperature is reached, switch off the oven, open the doors and start loading up the tile at the rear of the metal box.

Close the oven's door, switch on the oven and set up the baking temperature at 135°C for 3 h.

Note: Those above steps are highly critical to get out a homogenous and reliable baking. According to the oven, it must be defined by pre-tests which pre-heating temperature is preferred to achieve 135°C after loading the tiles. Start the time only when 135°C are reached.

Remove the tiles from oven after baking period and leave to cool overnight.

The tiles must cool and age during 24 hours minimum in a controlled temperature/humidity environment if possible (relative humidity of $50 \% \pm 10 \%$ at $21^\circ\text{C} \pm 2^\circ\text{C}$). If the relative humidity is not within this range, at least humidity and temperature must be recorded.

For one test series, it is advised against to use plates which were stored under different conditions

If the tiles are placed out of a humidity cabinet, make sure the tiles are lying perfectly flat and out of any direct sunlight or any source of heat.

Start Cleaning Test after 24 hours. Tiles can be used till maximum 2 days after preparation, if kept under controlled temperature/humidity conditions as described above.

6.1.6 Cleaning Step

Four detergents can be tested on the same tile. So a batch of eight tiles allows to test four detergents within eight replicates. The position of the detergents must be randomized across

the tiles so each product has been tested at least once in every position on the cleaning machine.

As the contact time (soaking) between product, sponge and soil has an influence on the performance of the product to remove the soil, it is recommended to evaluate not four products at the same time on one test plate.

The time difference between the first product and the fourth product applied would be too big, and would negatively impact the variance of the overall test results. Therefore, in this particular method it is recommended to only test two products at the same time.

The two unused sponge holders should be raised up and strapped to the horizontal bridge with the help of elastic rubber bands, in order to prevent them to come down and scratch the soiled surface during the cleaning run. After the first two products have been tested, the two remaining products should be evaluated on the two other tile positions, by lowering the unused sponge holders back to original position, and lifting plus strapping the just used holders to the bridge.

Rinse out the sponges in washing machine (rinse cycle at 1000 to 1400 rpm) upfront starting the cleaning step.

Place the soiled tile on the Sheen machine within 200 g weight above the sponge holder. Set the machine to 20 cycles/minute.

Depending on the direction, the recommended sponges have different elasticities. In one test series, use the sides of the same consistency (Hardness or weakness, see picture) of the sponge for wiping, cf. [Fig. 1](#).

For each of the positions intended to be cleaned, quickly apply 2 mL of neat product directly homogeneously on the sponge with a pipette.

After all products have been applied, put bridge with sponges into place. Set counter to zero and turn on cleaning apparatus. Each sponge can be used once.

An end point for a particular product is reached when the respective section of tile is 90 % to 100 % clean.

Record the number of cycles required to reach this end-point for each product.

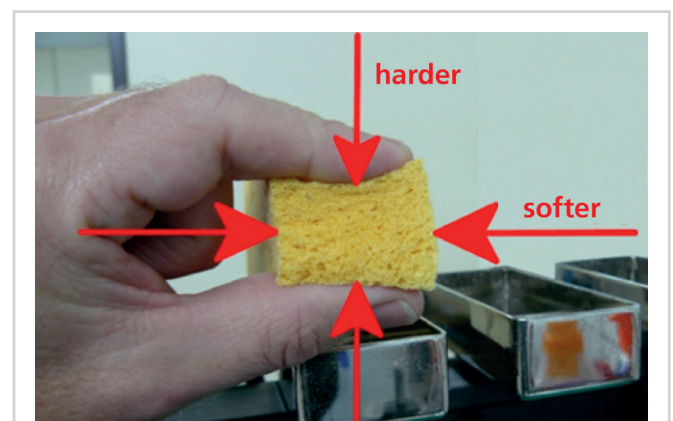


Fig.1 Different elasticities of the the recommended sponges
(Picture Credits: Thurn Produkte GmbH)

The end point can be assessed visually and "by contact", meaning by gently touching the soiled tile to ensure no grease remains on.

Note: it is preferable to run in parallel to the tested product a reference detergent where the results are well known. It allows to check out the soil tenacity and validate the baking process of each batch carried out.

If the end point is not reached in any test position after 100 strokes, stop this replicate test run and assign a value of 100 for that particular product.

6.1.7 Tiles Cleaning After Testing

Once the cleaning testing is completed, soiled tiles are soaked at least 30min in the oven cleaner before being gently hand rubbed with a sponge (see **Appendix B** for specifications).

6.1.8. Statistical Analysis of Data

The data are statistically analysed with an ANOVA (ANalysis Of VAriance) based e.g. on the Tukey's test with 95% confidence level.

6.1.9 Description of the Result for Cleaning Performance

The result may be described only in connection with relevant test conditions, because the achieved cleaning performance depends on the number of times scrubbed. Cross-comparisons with grades from different tests are not permissible.

6.2 Material Care

Stress cracking corrosion test with small plastic sticks based on German standard DIN 53449 T 1-3 (II).

A non-rusting steel pin (supply source 2) (dowel pin DIN 6325 Tol.: m6 3x10) is pressed in test sticks into which a hole has been drilled (drill 2.7 and reamer 2.9 H7), using a device e.g. rack and pinion press type 5 (supply source 3). The pin must be inserted vertically.

The test plastic sticks (supply source 4) are dipped briefly in the concentrated cleaner to be tested. Adhering cleaner is not removed. Dipping is repeated after 24 h. Every 24 h the dipping process is repeated, in total 5 dipping processes. The occurrence of stress cracks is evaluated after defined periods of time (24 hours after the first dipping process and 24 hours after the seventh dipping process and 7 days) and documented in tabular form.

It is recommended to run the first dipping process on a Monday and to proceed as follows:

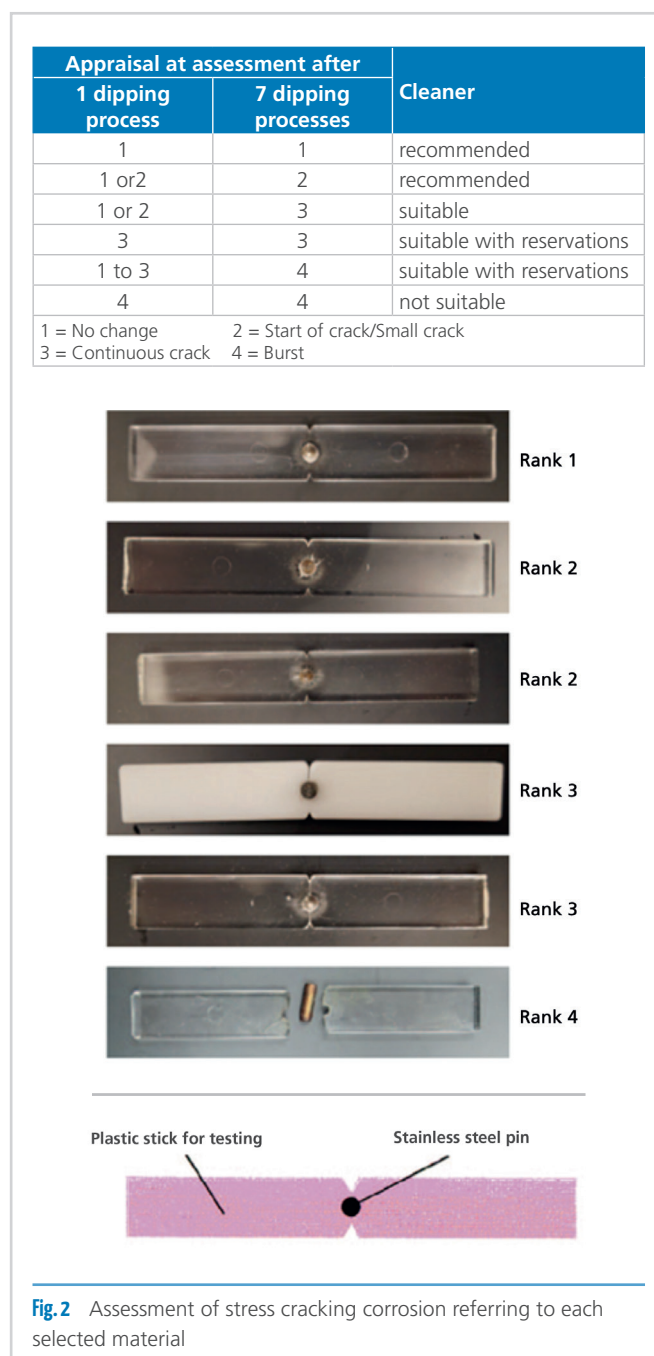
- Monday, 9 o'clock: first dipping process
- Tuesday, 9 o'clock: Evaluation after the first dipping process, then second dipping process
- Wednesday, 9 o'clock: third dipping process
- Thursday, 9 o'clock: fourth dipping process
- Friday, 9 o'clock: fifth dipping process
- Saturday, Sunday: Pause
- Monday, 9 o'clock: sixth dipping process
- Tuesday, 9 o'clock: seventh dipping process

- Wednesday, 9 o'clock: evaluation after the seventh dipping process

The Following Plastics can be tested (supply source 4):

- ABS = Acrylonitrile butadiene styrene Novodur P2MC
- PC = Polycarbonate Makrolon 3103 FBL 55/115
- PMMA = Polymethyl methacrylate Plexiglas 8N
- POM = Polyoxymethylene Hostaform 13031 XAS
- POM = Polyoxymethylene Hostaform C 9021 GV (= glass fibre reinforced) 1/30

Depending on the result of this test, it should be advised against a frequent or enduring use on certain plastic materials. The selected materials may undergo changes and can be adapted to new trends. In the following, an explanation of the assessment (cf. **Fig. 2**):



Assessment

If there are visible traces on the surface, it must be found out whether they can be removed by polishing with a soft cloth. If those traces can be removed with a soft cloth, there is no attack on material.

Assessment of Material Care

Test sticks are inspected, in an independent appraisal, by an experienced person with no knowledge of the respective product. The appraisal of material care should be performed and assessed separately for each tested plastic material.

Description of the Result for Material Care

The result may be described only in connection with relevant test conditions. Cross-comparisons with grades from different tests are not permissible.

6.3 Product Characterisation

Documenting the consistency and pH value is recommended, but such documentation is not part of the quality assessment.

Supply Sources

- (1) Multi-track Sheen Wet Abrasion, Scrub Tester Ref. 903/PG: Sheen Instruments Ltd., Unit 4, St. Georges Ind. Est., Richmond, Road, Kingston KT2 5 BQ, Great Britain
phone: +44 208 5414333, fax: +44 208 5493374
- (2) Dowel pin – Zylinderstift DIN 6325, 3 x 10 Tolerance zone: m6, Article no. 2520310, Fa. Würth, Reinhold-Würth-Straße 12-17, 74650 Künzelsau, Germany
phone: +49 7940-15-0, fax: +49-7940-15-1000, e-mail: info@wuerth.com
- (3) Rack and pinion press type 5 – Zahnstangenpresse Typ 5, Schmidt Technology GmbH, Feldbergstraße 1, Postfach 14 65, 78112 St. Georgen/Schwarzwald, Germany
phone: +49 7724 899-0, fax: +49 7724 899-101, e-mail: info@schmidttechnology.de
- (4) Test plastic sticks – Kunststoff-Prüfstäbe, Kunststofftechnik Buzzi GmbH, Vor Heubach 4, 77761 Schiltach, Germany
phone: +49 7836 96 830, fax: +497836 96 832, e-mail: info@kst-buzzi.de

Literature

- (I) IKW, SOFW-Journal/English version, Tome 141, No 4, 2015, pages 28-36.
- (II) Beuth Verlag GmbH, Burggrafenstraße 6, 10787 Berlin, Germany;
www.beuth.de

Members of the Working Group

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Appendix A Equipment and Materials

Sheen PG 903 Scrubber

Stainless Steel Tile

At least 25 cm x 8 cm, 1 mm thickness, type 18/8 or 18/10 stainless steel (containing 18% chromium and 8-10% nickel) mirror polished.

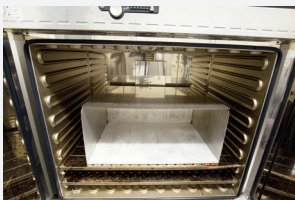
Painting Roller

7 cm length x 6 cm diameter, made from synthetic sponge.

Oven

e. g. Memmert UFE 600;

Memmert GmbH + Co. KG, Äußere Rittersbacher Straße 38, 91126 SCHWABACH, GERMANY



Metal Box for Baking Process

Metal box in the oven (see Fig.), *Picture Credits:* Anthony Million, Eurofins

Dimension: height x length x width = 26 cm x 59 cm x 40 cm

Sponge

Yellow cellulose, cut in 9x4cm to fit the sponge holder of the sheen machine (cf. picture), e. g. "Spontex Viskoseschwämme feinporig" (Viscose-Sponges, fine pored)

90 mm x 40 mm x 40 mm, Artikel Nr. Z147000, MAPA GmbH, Industriestraße 21-25, 27404 ZEVEN, GERMANY

Appendix B Soil Ingredient List

Peanut Oil (e.g. Goccia d'oro, Mazola, M-Classic)

100 mL of oil consist in
 91,6 g to 92 g of fat within fatty acids:
 12 g to 18 g saturated,
 55 g to 66 g unsaturated,
 14 g to 16 g polyunsaturated

Sunflower Oil (e.g. M-Classic, Rapunzel Bio Nativ, Wielkopolski)

100 g of oil consist in approx. 92 g fat within fatty acids:
 10 g to 11 g of saturated,
 24 g to 29 g of mono-unsaturated,
 53 g to 62 g of poly-unsaturated

Corn Oil (e.g. Goccia d'oro, Mazola)

100 g of oil consists in approx. 92 g fat within fatty acids:
 12 g to 13 g saturated,
 25 g to 30 g mono-unsaturated,
 53 g to 57 g poly-unsaturated

HSW Soil

This soil consists of:

Ingredient	Percentage
Humus (NTC Clay)	34.8
Cement	15.0
Silica Gel	15.0
Clay (Stanley)	15.0
Gelatine Powder	3.5
Sodium Chloride (Salt)	5.0
Rust	0.3
Carbon Black	1.5
KTC Vegetable Oil	9.9
Total	100.0

From Warwick Equest (ordered by using "HSW" soil).

Colourant: Lumogen F Red 305 (BASF)

Carbon Black: Spezialschwarz 4 (Evonik)

Cleaner for Tile Pre-treatment or for Tile Cleaning after Testing

Any cleaner within sodium hydroxide is suitable for use. A professional oven cleaner based on sodium hydroxide is recommended, e.g.:

Ingredient	Percentage
Soft water Europe chlorinated	77.250
SODIUM HYDROXIDE	11.000
POLYACRYLATE	0.750
MONOETHANOLAMINE	3.200
SODIUM GLUCONATE	7.000
LAURAMINE OXIDE	0.600
Triton H-66	0.200

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