

# SCIENTIFIC PAPER

When every detail counts

## Tracing the development of a cleaning agent

A cleaning agent is a perfectly normal product. Trends, standards, technologies and new business models influence the development. They range traditionally from product concept and specifications to prototypes and reality check through to series production. But there are sticking points to consider, for which the chemistry must be accurate – in order to prevent everything sinking into foam or the container melting. A journey into the world of surfactants, test dirt and ultra-moistening water drops.

### Conditions:

#### Raw materials, trends and co.

Cleaning agents should combat dirt as effectively as possible, be efficient and where possible not present any risks to both the user and the environment. Chemical laboratories face this challenge day after day, embedded in diverse conditions.

Current developments on the raw materials market must be already followed at the outset in the design of cleaning agents in order to avoid procurement problems later. In addition, the topic of recyclability plays a central role, and also digitisation does not stop at cleaning agents. Even though there are still no nanobots, automatic consumption measurement and delivery are already on the rise.

Technological innovations often come from other industries, e.g. the automotive area. Liquid silicones, used there as sealants, plasticisers and corrosion protection, are now used in cleaning agents. For the maintenance of stone or wooden floors, they fill the joints during cleaning so that no water penetrates. The agents do not build up layers, i.e. do not remain on the surface after the work.

### Press Contact

Linda Schrödter  
Press Officer  
Alfred Kärcher SE & Co. KG  
Alfred-Kärcher-Str. 28–40  
71364 Winnenden

T +49 (0) 71 95 14-3918  
F +49 (0) 71 95 14-2193  
[linda.schroedter@de.kaercher.com](mailto:linda.schroedter@de.kaercher.com)

# SCIENTIFIC PAPER

Different international trends are also fascinating. Whereas phosphate-free is an almost indispensable property in Europe, products with phosphate are in demand in the USA. Uniform standards would make the development of new cleaning agents much easier.

Another driving force is new business models such as Cost per Use. In this case, using the example of a gantry car wash for cars, a number of cleaning agents is not sold, but the number of car washes for a certain amount – which makes it much easier for the customer to predict the costs.

## **Development:**

### **The long way to reaching the target.**

What should the cleaning agent do? This question is asked at the beginning of the development process and starts with ideas and concept phase and is transferred to the development of chemical substances with specifications. There concept proposals are acted out and functional models are created for product properties. A key challenge, for example, is to get different types of dirt soluble in water. For this, various surfactant combinations are tested, which make the water drops ultra-moistening, minimise the contact angle and thus efficiently remove the dirt. Other functions dissolve oil, reduce the amount of foam or bind hardeners in order to prevent the formation of limescale.

In the lab standardised test dirt for household and industry is removed from standardised test panels at consistent pressure and speed in order to examine the effectiveness. First of all, individual substances are observed; then the entire product, consisting of between five and thirty components, which must be harmonised.

At the end of this test comes the specifications, which define the product for the final development in detail. Then it is time for the reality check. The cleaning agent must demonstrate its abilities using a scrubber drier, wiping mop and co. Is the amount of foam right, is the ph

# SCIENTIFIC PAPER

value OK, are there any streaks and does the cleaning agent remain stable? All these and other questions are analysed in detail. In the preseries larger quantities are produced in order to present the product to customers in the field test. This last hardness test also includes questions about scent and haptics, as well as the cleaning behaviour in daily application. When this phase is passed and if all functions are optimally matched, the market launch follows with series production.

## **Details:**

### **When the series production does not follow the laboratory and other uncertainties.**

If the development process sounds linear, then there are some pitfalls built in, which pose additional challenges and may lead to delays. A case that is not uncommon: The initial production in series does not fulfil the criteria, which the cleaning agent satisfied in the development stage. Because lab conditions, where exact mixtures are proportioned to the milligram for one litre of active ingredients, cannot be transferred 1:1 to large-scale production. The mixing process in a test tube is also different than in the large tank, resulting in a slight modification of the effect of the cleaning agent. The developers are again asked to optimise the formula, sequence of the ingredients and definition of inactive phases so that the final product successfully passes all measurements.

The cleaning agent must be transferred from the tank to a suitable container – another topic which can also be very exciting. Because chemistry and packaging must fit together in order to avoid, for example, deformations after the diffusion of alcohol. The container must also pass drop tests and remain sealed upon impact. Finally, packaging is subject to transport tests in order to avoid unwelcome surprises on journeys. For cleaning tabs in water-soluble foil packaging should be procured that withstands climate fluctuations – especially due to higher humidity – and therefore protects the product against the penetration of water.

Many cleaning agents in spray bottles are used, which are appreciated

# SCIENTIFIC PAPER

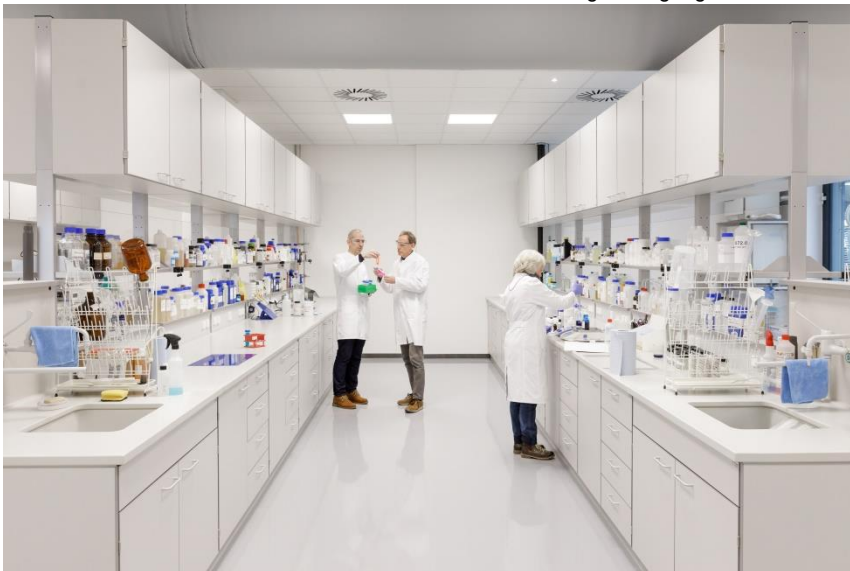
by users. And also the output of the chemicals industry is a separate discipline in product development, which must be well thought-out. The spray head must be ergonomic, the inhalation of aerosols should be prevented where possible, the spray head must apply the foam at the desired width and be robust enough for the contents therein.

## **Supplement:**

### **When a cleaning agent has to be adapted.**

If a cleaning agent is widely used in practice, the developers are reluctant to change the formula. But sometimes it may transpire, for example, that more foam is produced when using a new machine than desired. An anti-foam surfactant must be added – without changing the effect of the cleaning agent through the reaction with other ingredients. Another challenge that the developers are constantly confronted with in their chemistry labs.

Kaercher\_Entwicklung\_Reinigungsmittel\_en.docx



*What should the cleaning agent do? This question is asked at the beginning of the development process.*

# SCIENTIFIC PAPER



*In the development of chemicals concept proposals are acted out and functional models are created for product properties.*



*In the lab standardised test dirt for household and industry is removed from standardised test panels at consistent pressure and speed in order to examine the effectiveness.*

# SCIENTIFIC PAPER



*At the end of this test come the specifications, which define the product for the final development in detail.*



*Formula, sequence of the ingredients and definition of inactive phases must be optimised.*



# SCIENTIFIC PAPER



*Foam development is checked.*



*The cleaning agent must demonstrate its abilities using a scrubber drier.*

# SCIENTIFIC PAPER



*Measuring the degree of gloss.*



*The properties of the product are also tested in the manual application.*



# SCIENTIFIC PAPER



*The spray head should be ergonomic.*



*At the end the cleaning agent is transferred to series production.*