

How about a customized soap or shampoo created using AI?

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SINTEF has played a key role in the development of a Manufacturing Demonstration Facility (MDF), or "mini-factory," in collaboration with the company Cody AS, based in Skien. Credit: SINTEF

Researchers have recently discovered a new way of making consumer items. They've developed a machine, based on AI technology, that can customize personal care products to your own requirements.

There is no shortage of soaps and detergents on the market. However, by customizing these products, it is possible to meet consumers' increasingly demanding requirements and at the same time make them more eco-friendly.

"By enabling consumers to design their own personal version of a soap or detergent, we can minimize waste, exploit our resources more sustainably and get the product to the customer more quickly," says Chief Research Scientist Chandana Ratnayake at SINTEF Industry.

The demand for low-price consumer goods with short shelf lives and rapid-response supply chains is on the increase. Typical of these are the so-called "fast-moving consumer goods," or FMCGs, such as food, [personal care products](#), clothes and other household articles.

Specialization in small-scale production

As a rule, detergents, such as soaps and washing powders, are mass-produced. From a manufacturer's point of view, they can in some cases also be very challenging to make, or "formulate."

In order to be competitive, manufacturers have to balance increased demand with factors such as specific health and well-being benefits, allergies, individual tastes, and other consumer requirements that may change very rapidly. They also have to take sustainability and environmental considerations into account.

This is the background to the EU-funded project called DIY4U, which is looking into how these challenges can be met by means of the

development, manufacture and commercialization of customized detergent products.

"Our aim here is to develop an approach to the profitable and sustainable small-scale manufacture of specialized products that can be offered to the [industrial sector](#), businesses and entrepreneurs," says Chandana Ratnayake.

The market for powder- and liquid-based detergents is large and lucrative, but these products are also some of the most complex fast-moving consumer goods (FMCGs) to formulate.

"The formulation of powder- and liquid-based detergents is challenging due to the complex balance that has to be achieved between what we call surface-active agents, other [chemical compounds](#) and additive components" explains Ratnayake. "These components are essential in order to prevent damage to the items being washed and harm to the external environment. The product must also be adaptable to a wide range of different water types and temperatures," he says.

AI makes it possible

Researchers working with the DIY4U project have been collaborating with major industrial actors in the groceries sector and some small- and medium-sized businesses based in the EU. They have approached this challenge by developing a consumer-focused "open innovation" [digital platform](#) that is connected to a fully automated, small-scale manufacturing facility (FabLab).

SINTEF has been contributing with its expertise and access to pilot-scale test facilities for the handling of powders and particles. It has assumed responsibility for the testing and fine-tuning of customized mixing systems for the raw materials that go to make up powder-based

detergents.

"By utilizing [digital technologies](#) such as artificial intelligence, blockchain and advanced data analysis, consumers can be enabled to interact directly with the digital platform," says Ratnayake. "This allows them to enter their own preferences regarding allergies, odor, color and volume, as well as the types of stain that they would like to see removed," he says. He goes on to add that a digital twin has been used to optimize [production processes](#) such as the mixing of ingredients and fragrance formulation.

Based on the preferences entered, the platform uses its knowledge base to suggest one or more formulations that meet the customer's requirements, and to offer information about costs and environmental footprint. It then sends a notification to a Manufacturing Demonstration Facility (MDF), or "mini-factory," in order to start the production process.

Expansion into multiple markets

The current MDF production facilities are modular, offering the potential to apply the concept to other products and services. This means that there is an opportunity to expand this innovation into other market segments such as cosmetics, food, drink and animal feed.

"In order to achieve this, we need both more research and innovation," says Ratnayake. "We also want to see input from businesses about what they need when it comes to product customization, special production processes, and more," he says.

Ratnayake is thus looking to encourage any industrial actors, businesses and entrepreneurs interested in testing processes for new product development, innovative ideas and "added value" to get in touch.

Creating opportunities for small and medium-sized businesses

The consumer-focused concept developed during the DIY4U project was made available to small- and medium-sized businesses by means of open innovation competitions. These businesses have played a key role in identifying ways of fine-tuning the digital platform and providing input to market analyses and feasibility studies.

The involvement of businesses resulted in increased market awareness and acceptance, as well as an opportunity to identify potential expansions into other sectors.

"To date, the concept has resulted in greater customer satisfaction. It has revealed market differences and potentially better pricing results, and the businesses involved in the project have provided us with positive feedback," says Ratnayake.

"The decentralized production process may also generate opportunities for small- and medium-sized businesses in markets currently dominated by larger corporations.

But what about the price of these types of product? "At present, it's difficult to say whether these products will be cheaper or retailed at current prices," says Ratnayake. "We've carried out studies into aspects such as [business plans](#), ecosystem development and stakeholder commitment, and believe that prices will depend on how a given [business](#) plan is implemented when the time comes," he explains.

The current project plan is to work to obtain new funding and support with the aim of attracting more end-users and market stakeholders. The project will also be working proactively with specific industrial sectors.

"Our intention is to build on the success that we have achieved to date and develop an advanced system in which end-users can design products that fully meet their needs," says Ratnayake.

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