

Edible food packaging made from milk proteins

1 At the grocery store, most foods -- meats, breads, cheeses, snacks -- come **wrapped** in plastic packaging. Not only
2 does this create a lot of non-recyclable, non-biodegradable waste, but thin plastic films are not good at **preventing**
3 spoilage. Some plastics are also suspected of leaching potentially **harmful compounds** into food. To **address** these
4 issues, scientists are now **developing** a packaging film made of milk proteins -- and it is even **edible**.

5 "The protein-based films are **powerful** oxygen blockers that help **prevent** food spoilage. When used in packaging,
6 they could prevent food waste during distribution along the food chain," says **research** leader Peggy Tomasula.
7 **Spoiled** food is just one issue. Current food packaging is mainly petroleum-based, which is not **sustainable**. It also
8 does not **degrade**, creating tons of plastic waste that sits in landfills for years.

9 To create an all-round better packaging solution, Tomasula and colleagues at the U.S. Department of **Agriculture** are
10 developing an environmentally friendly film made of the milk protein casein. These casein-based films are up to 500
11 times better than plastics at keeping oxygen away from food and, because they are derived from milk, are
12 **biodegradable**, sustainable, and edible. Some commercially **available** edible packaging varieties are already on the
13 market, but these are made of **starch**, which is more porous and allows oxygen to seep through its microholes. The
14 milk-based packaging, however, has smaller pores and can **thus** create a **tighter** network that keeps oxygen out.

15 **Although** the researchers' first **attempt** using pure casein **resulted** in a strong and effective oxygen blocker, it was
16 relatively hard to handle and would **dissolve** in water too quickly. They made some **improvements** by incorporating
17 citrus pectin into the **blend** to make the packaging even stronger, as well as more resistant to humidity and high
18 temperatures. After a few **additional** improvements, this casein-based packaging looks similar to store-bought plastic
19 **wrap**, but it is less stretchy and is better at blocking oxygen. The material is edible and made almost **entirely** of
20 proteins. **Nutritious additives** such as vitamins, probiotics, and nutraceuticals could be **included** in the future. It
21 does not have much taste, the researchers say, but flavourings could be added.

22 "The coatings **applications** for this product are endless," says Laetitia Bonnaillie, co-leader of the study. "We are
23 **currently** testing applications such as single-serve, edible food wrappers. **For instance, individually** wrapped
24 cheese sticks use a large proportion of plastic -- we would like **to fix** that." Because single-serve pouches would need
25 to stay sanitary, they would have to be encased in a larger plastic or cardboard container for sale on store shelves **to**
26 prevent them from getting wet or dirty.

27 In addition to being used as plastic pouches and wraps, this casein coating could be sprayed onto food, such as cereal
28 flakes or bars. Right now, cereals keep their crunch in milk **due to** a sugar coating. Instead of all that sugar,
29 manufacturers could spray on casein-protein coatings to prevent soggy cereal. The spray also could line pizza or other
30 food boxes to keep the grease from staining **the** packaging, or to serve as a lamination step for paper or cardboard
31 food boxes or plastic pouches. The U.S. Food & Drug Administration **recently banned** the perfluorinated substances
32 that used to coat these containers, so casein coatings could be a safe, biodegradable alternative.

33 Bonnaillie says her group is currently creating prototype film **samples** for a small company in Texas, and the
34 development has **generated** interest among other companies, too. The group plans to keep making improvements,
35 and she **predicts** this casein packaging will be on store shelves within 3 years.

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