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Edible Films and Coatings as an Alternative to Non-biodegradable Plastic Packaging

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4th April 2019, Sofia, Republic of Bulgaria

Plastic now pollutes every corner of Earth



including the seas and
oceans



The solutions or new issues?



Waste disposal sites and cost-intensive burning and recycling only shift the problem and cause new environmental concerns.

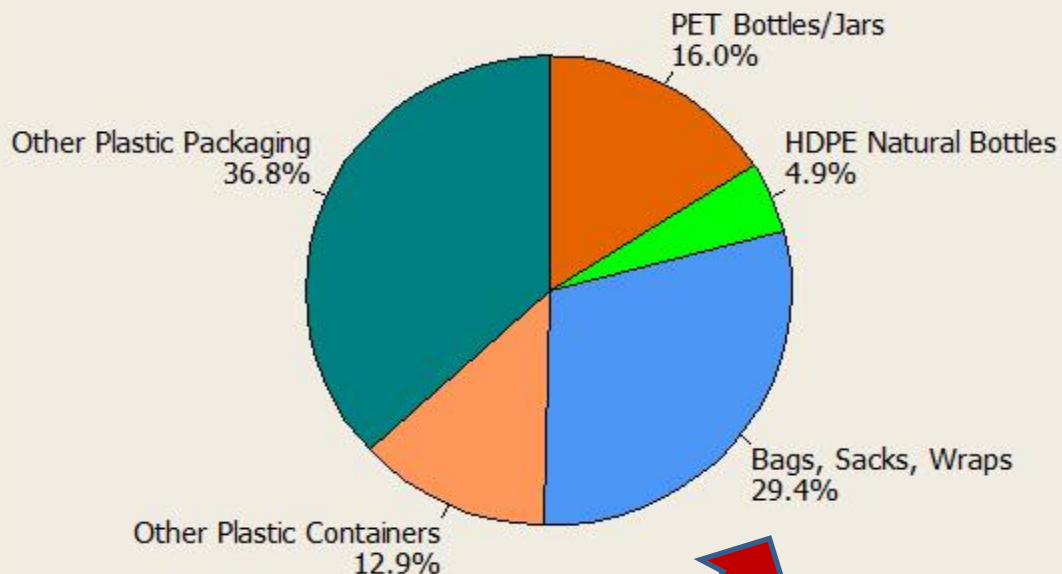


Biodegradable composite plastic sounds like a good idea but so far it hasn't been a very successful one.

Danger: microplastic!

Structure of Plastic Waste

Discarded Plastics in U.S.



29,4 % Bags, Sacks, Wraps



Biodegradable alternatives to conventional plastics but currently non- sustainable

Cellulose, it's derivatives, chitin, chitosan and other polysaccharides have great potential to contribute to material recovery, reduction of landfill and use of renewable resources. But *cellulose-based polymers utilize more nonrenewable fossil fuels and are more polluting during manufacture than petro-based polymers*. Cellulose-paper industry pollutes the environment as well.



Stay-of-the-art: there is no the only way out

✓ DIRECTIVE (EU) 2015/720 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

The consumption: not exceed **40 lightweight plastic carrier bags** (with a wall thickness below 50 microns) per person by **31 December 2025**. **Very lightweight plastic carrier bags** (with a wall thickness below 14 microns) **may be excluded from** national consumption objectives.



**198
now!**

Shrink, ban or without?

Strict ban: Australia, Hong Kong, Kenya, some states of India, Singapore, Bangladesh, Zanzibar, Rwanda, Hawaii. In South Africa, for the sale of plastic bags facing imprisonment. Since 2019 - New Zealand.

Reduce (due to fees, taxes or fines, life-bags): Italy, UK, France, Belgium, Germany, Denmark, Israel, Lithuania, Romania, Russia, Belarus, Azerbaijan, Kyrgyzstan, Georgia and etc.

Without packaging (packaging ourselves)



Buyers pack food by themselves

Zero Waste Bulk Store



Paper or long-life bags



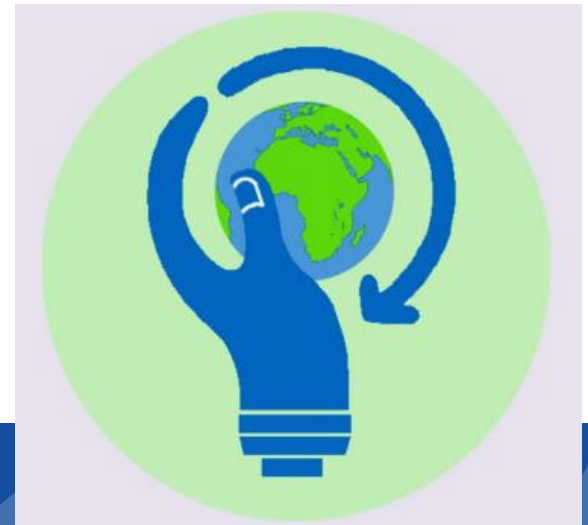
Washing of long-life bags = *E-coli* danger



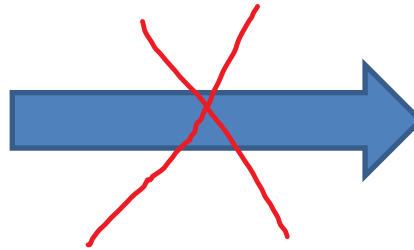
**J.Klick, J.D.Wright. Grocery Bag Bans and Foodborne
Illness /University of Pennsylvania Law School, Research paper, 2012**
<http://ssrn.com/abstract=2196481>

Stay-of-the-art: there is no the only way out

- ✓ **A European Strategy for Plastics in a Circular Economy sets a series of ambitious targets and initiatives up to 2030, within a spirit of commitment to future generations (Brussels, 16.1.2018)**
- ✓ Re-use and recycling with the ambition to reach 60% for plastics packaging by 2030; 100% re-use, recycling and/or recovery of all plastics packaging in the EU-28, Norway and Switzerland by 2040.
- ✓ Preventing Plastics Leakage into the Environment
- ✓ Accelerating Resource Efficiency



What about non-reusable, non-recyclable bags ?



The inherently biodegradable packaging

Edible films and coatings are the only type of biodegradable polymer packaging that does not require individual collection and special disposal conditions.

Edible films and coatings are biodegradable polymeric materials that demonstrate the mechanism of biodegradation under the action of intracellular and non-cellular enzymes (endo- and exoenzymes) contained in the stomach and intestines of humans and animals, which is alternative to the microbial mechanism (environmental degradation by bacteria or fungi), consisting in the oxidation and hydrolysis reactions.

This is the **primary packaging for edible ingredients, which in most cases requires external, secondary packaging!**

Edible films are not meant to, or could they ever, replace non-edible outer packaging



Edible films developed at BSU



**More than 80%
of starch**



Starch films production in China has been implemented by skillful women's hands



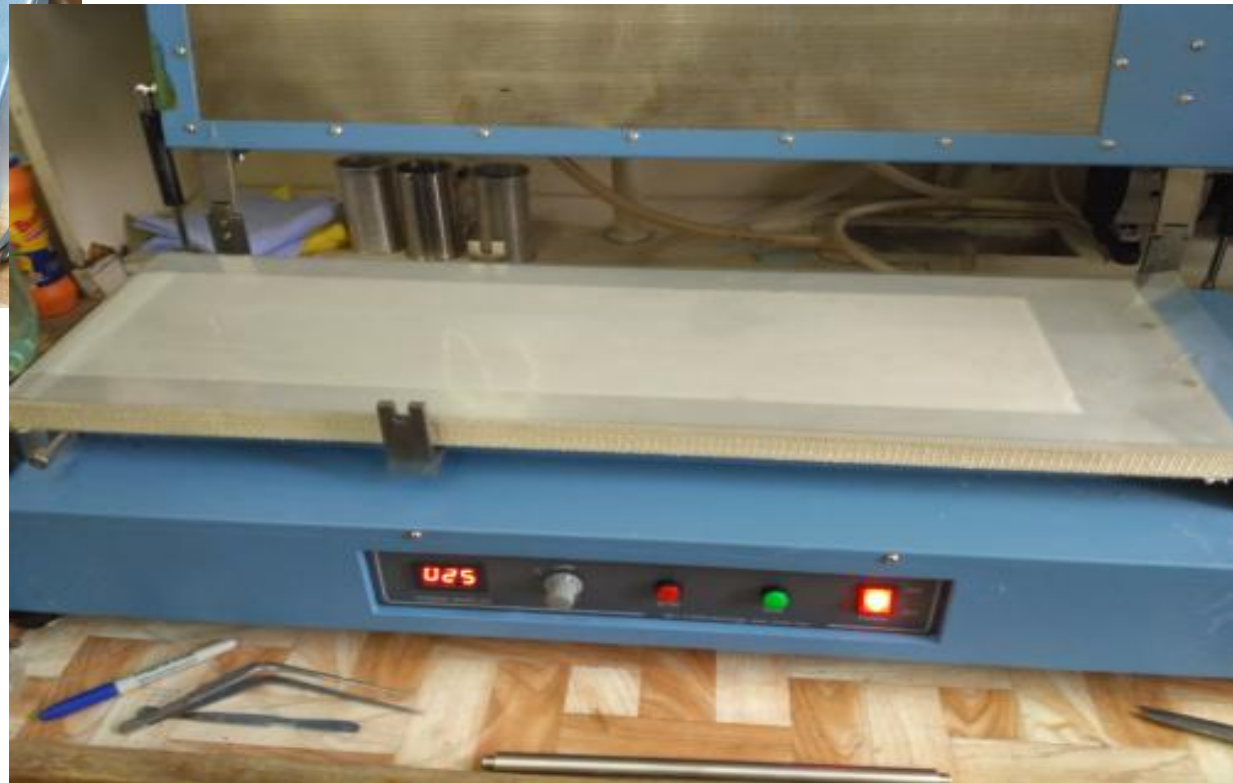
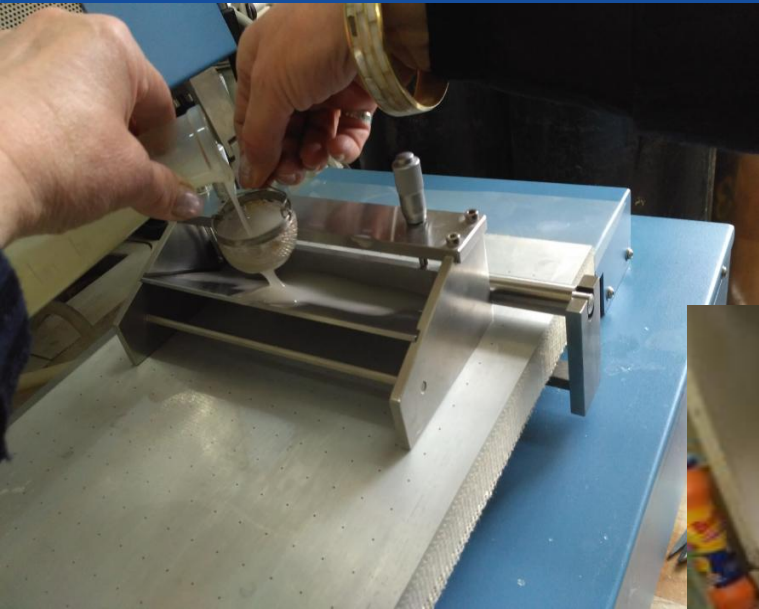


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**Candies in edible primary packaging.
Starch films are not strong and elastic
according to chemical nature of starch.**



Films composition and technology production was tested by different scale equipment: Lab at BSU, Belarus





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Small pilot-scale equipment in USA



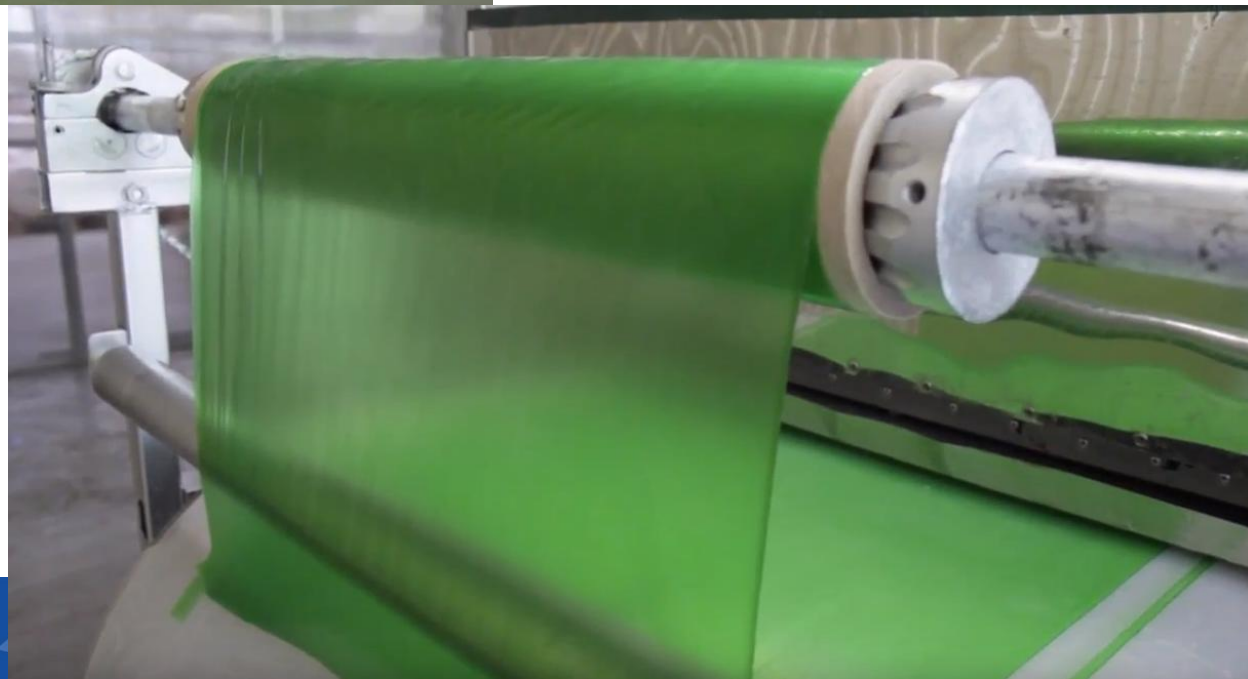
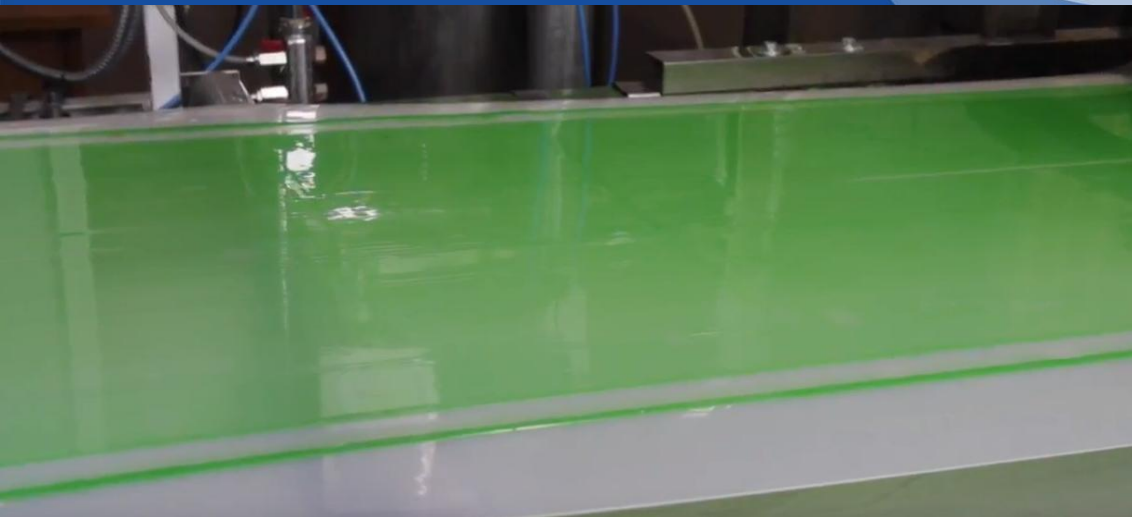
Pilot-scale Equipment





Pilot-scale machine developed by LLC “Borisov’s plant of plastic packaging “Polimiz” in Belarus

Film casting

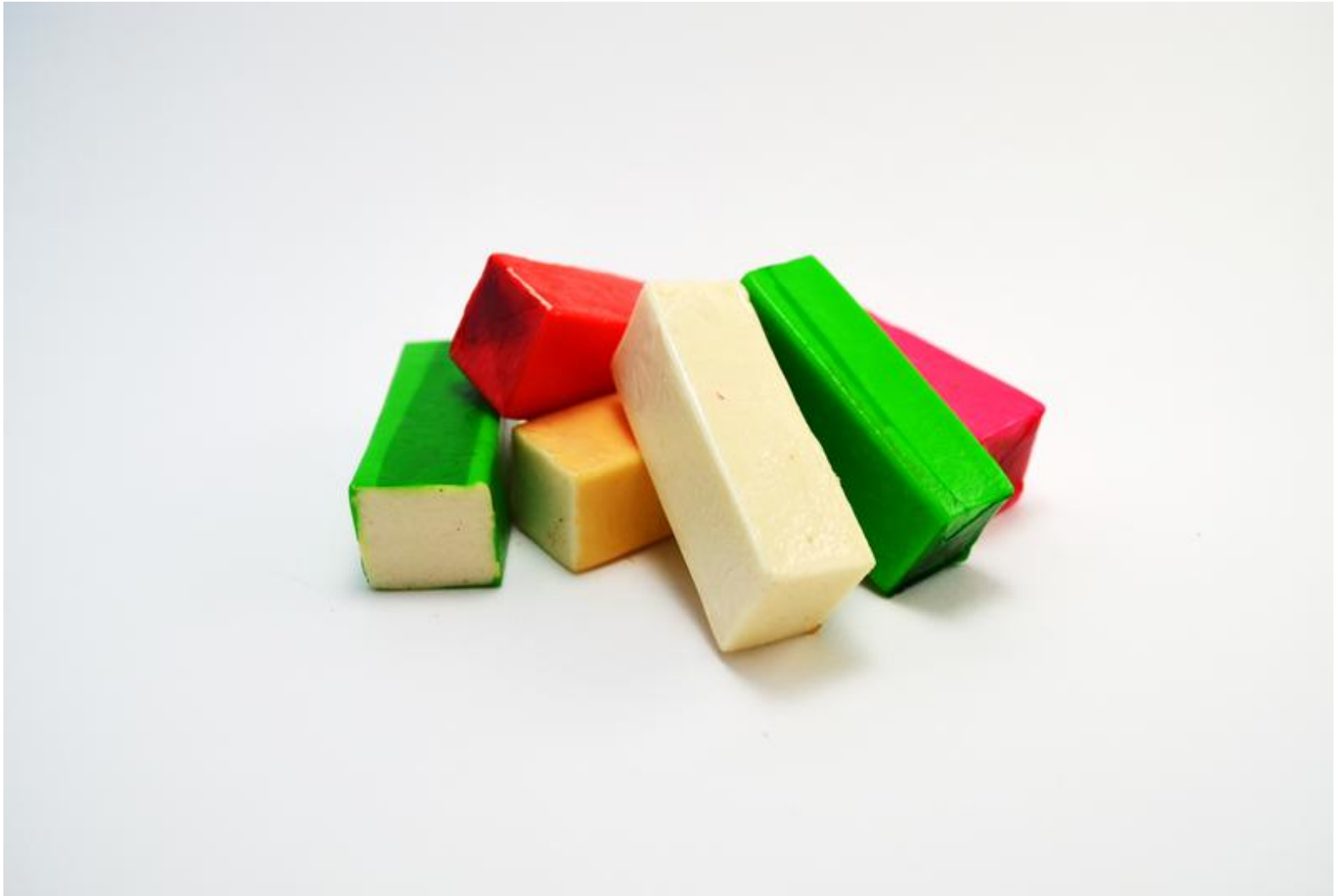


Edible films colored by food dyes



Examples of possible application

Tensile strength is the main BSU films' advantage



Wrappers for candy with natural anti-caries additives



It is tasty!



Portion packaging



For honey packaging





**American astronaut Anna Lee Fisher
at BSU in 2018:**

"Honey in edible packaging is what
we lacked in space "
"



Edible Tartlets



” ПЛЕНКА ИМЕЕТ ОТЛИЧНЫЕ ВКУСОВЫЕ СВОЙСТВА,
ОНА БИОРАЗЛАГАЕМА И НЕ ТРЕБУЕТ УТИЛИЗАЦИИ

For baking cakes

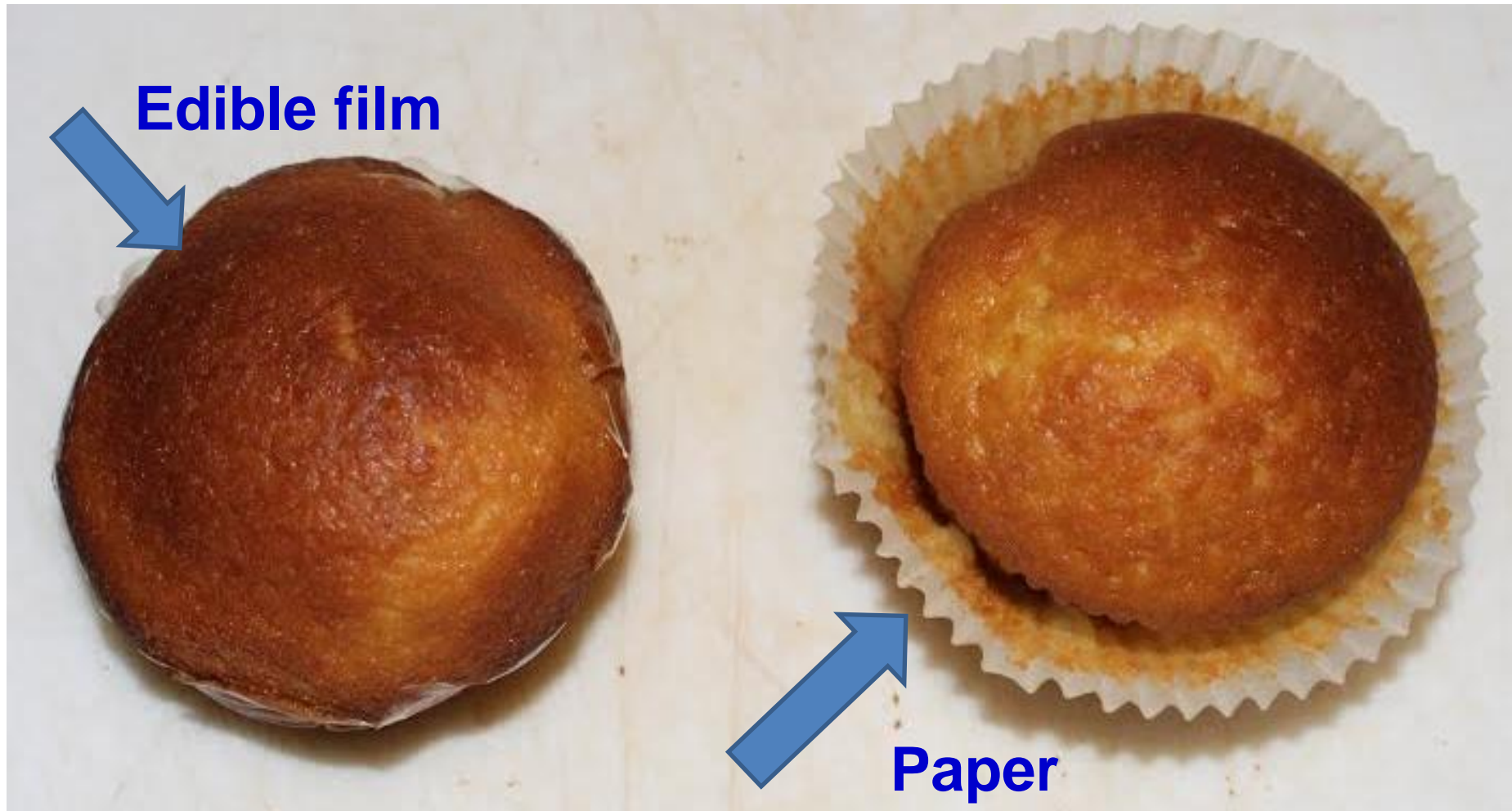


Edible packaging for baking cakes



Edible film

Edible packaging for baking cakes



Edible packaging for baking cupcakes



Edible packaging for soft candy, marmalade





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Edible coating instead of sugar and wax

Conventional
coatings



Edible coating



Edible packaging for spices



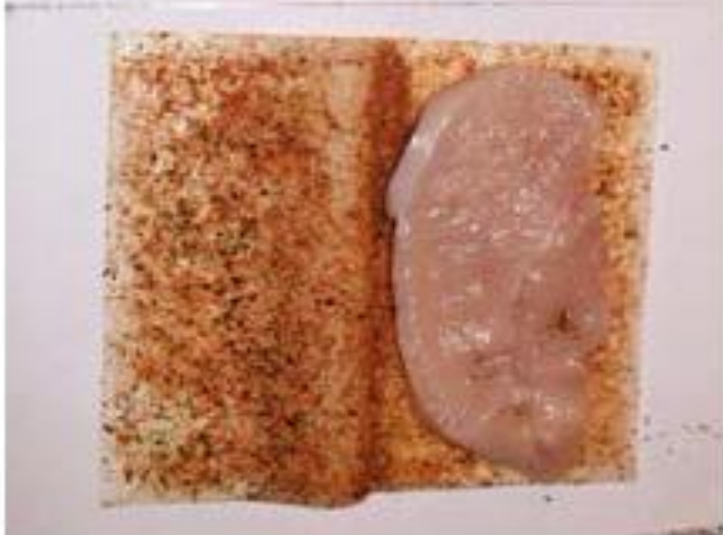
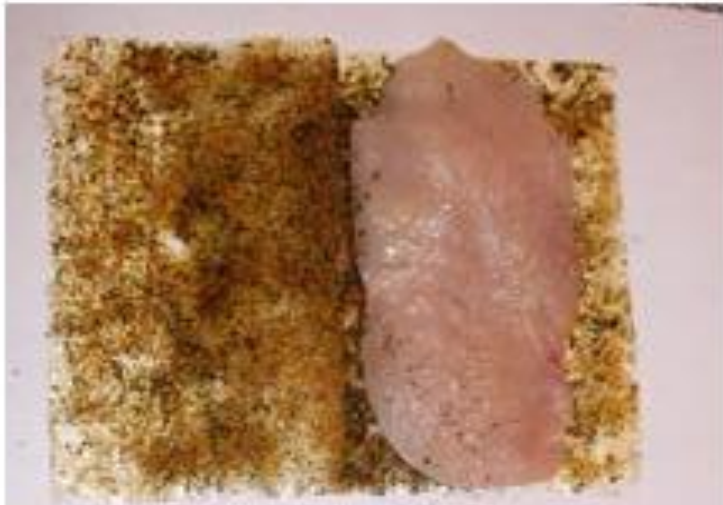
Edible packaging for instant noodles spices



**They dissolve without changing noodle
taste**



Edible films for frying fish, poultry



Edible films for frying poultry



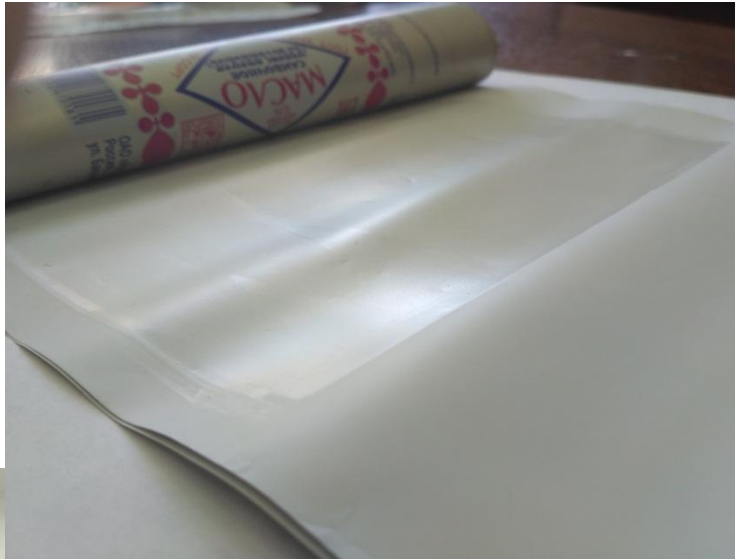
Edible films for frying poultry



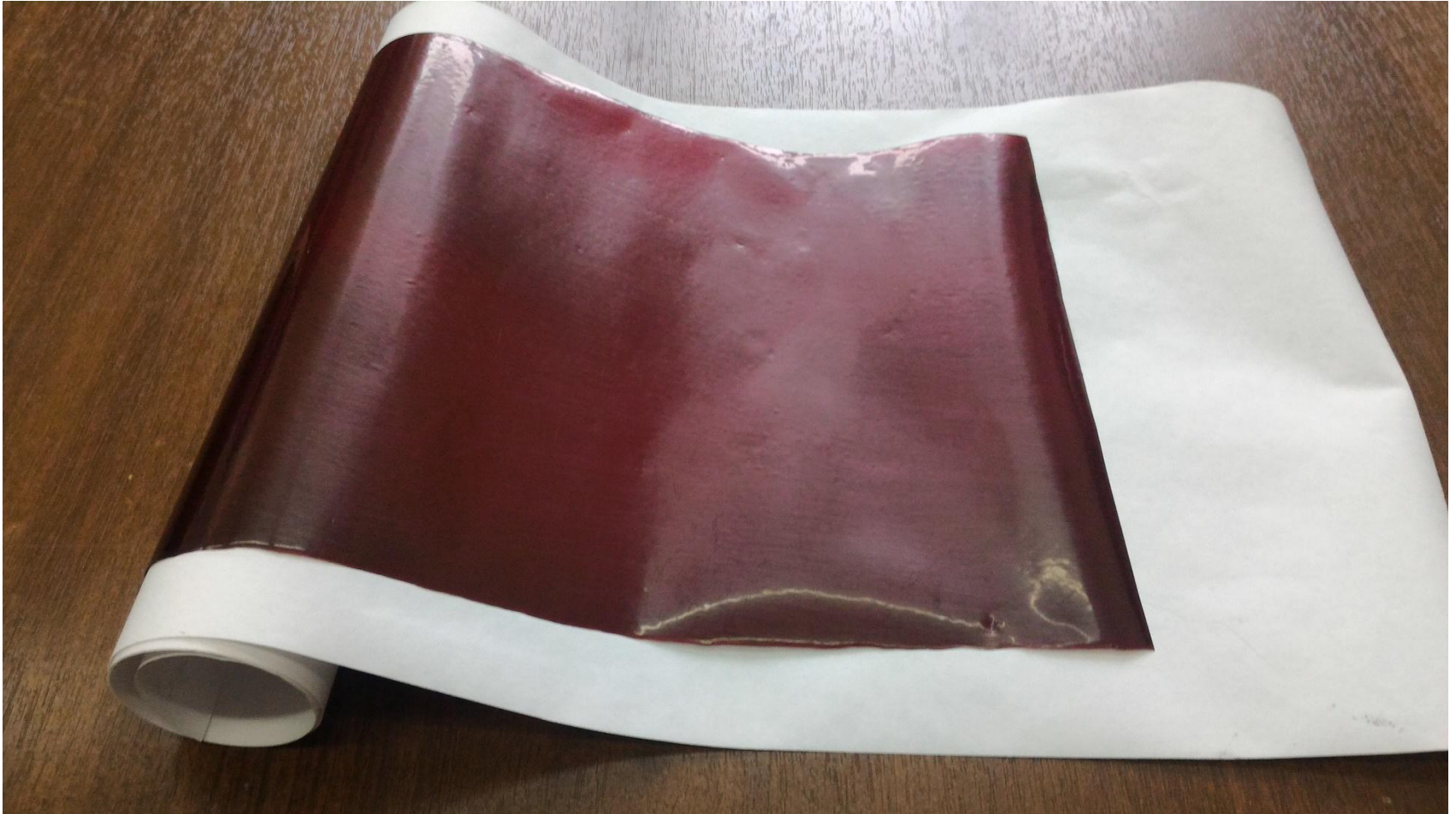


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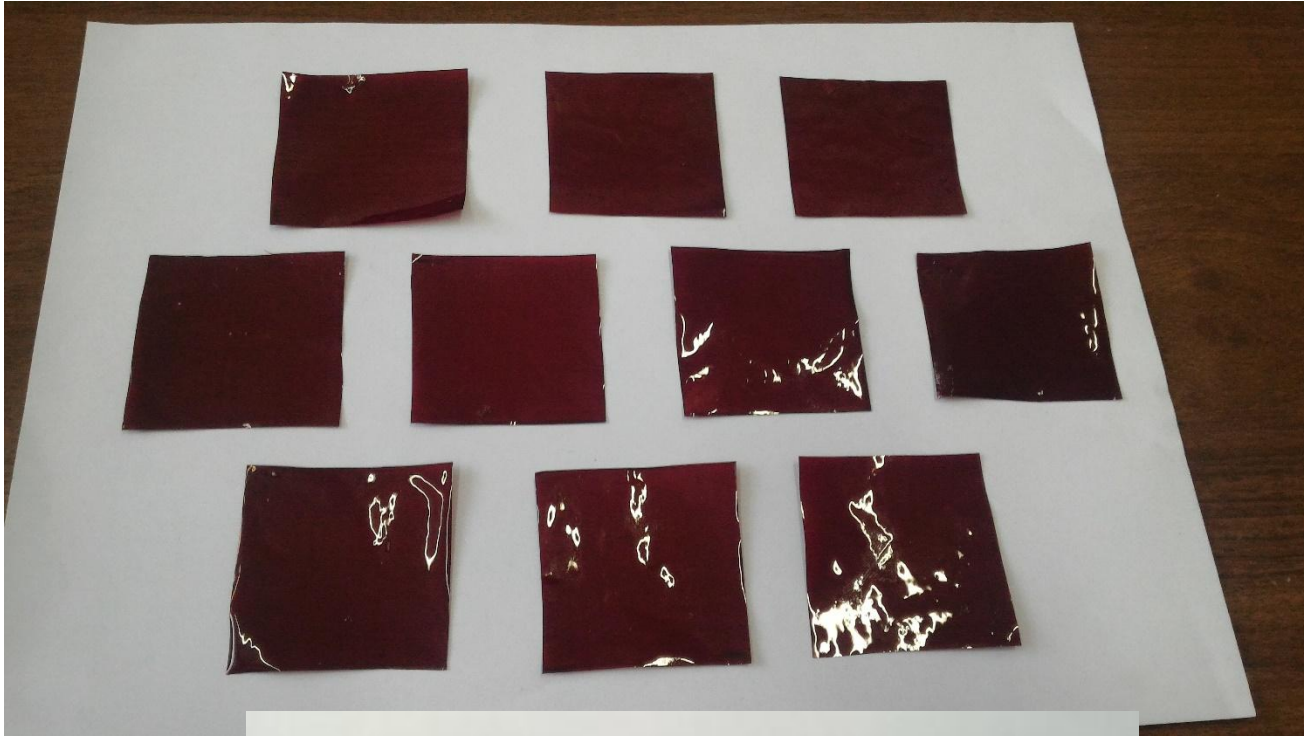
Edible coating for inner packaging of butter



Easter eggs coloring film



Easter eggs coloring film



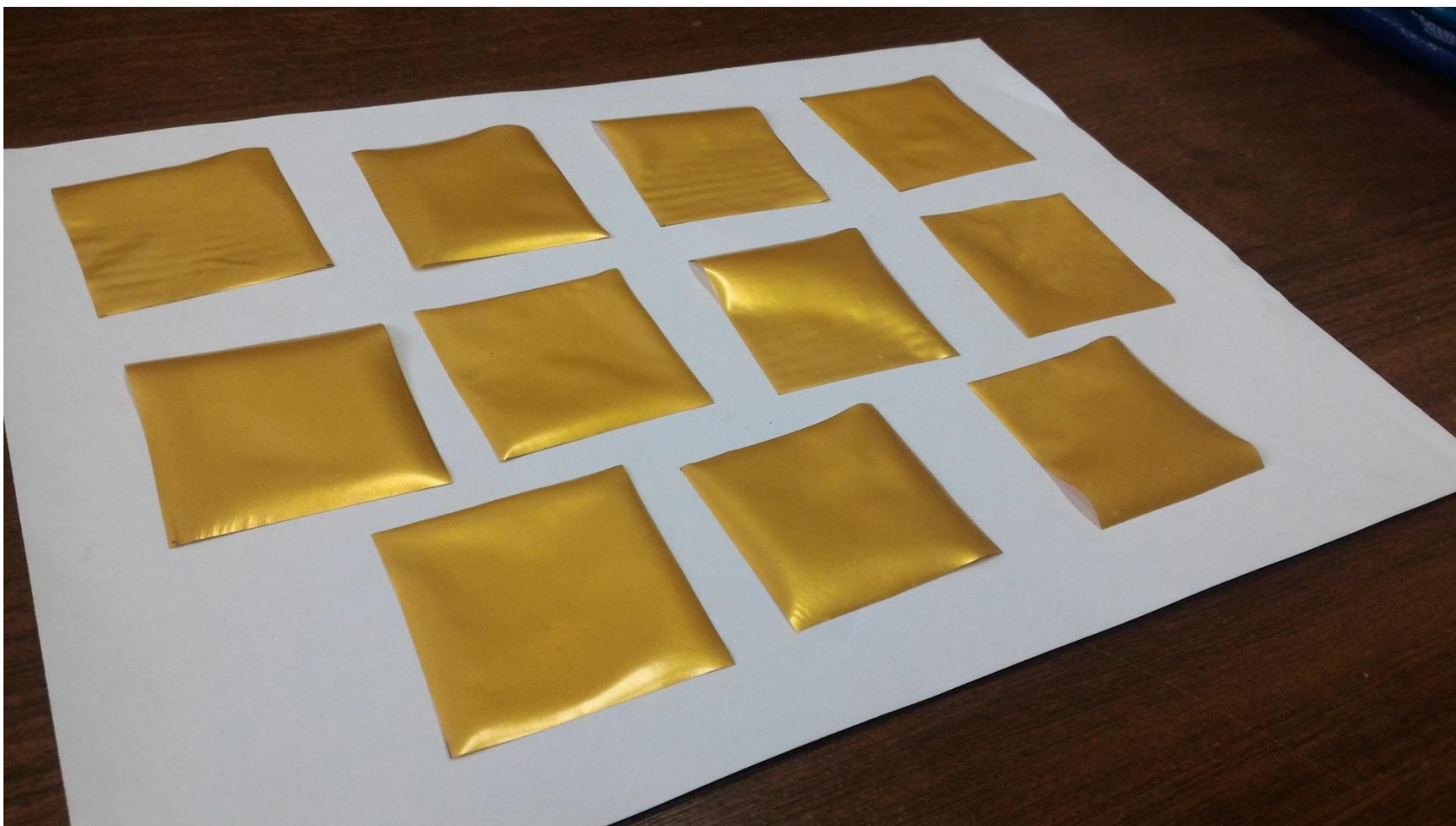
Easter eggs coloring films



Edible decoration films



Edible decoration films



Unexpected additives



Chinese mushroom for long life



**Complete replacement of
synthetic packaging is
impossible, *but its use may be
limited through the
development of
edible films and coatings* for
certain commodity groups**



TOP STORIES / ENVIRONMENT

WASTE

Edible film: The future of eco-friendly packaging?

Food packaging is a major source of plastic waste. Developing wrapping that is edible could help - not just the environment, but maybe even taste, too. A scientist at a green chemistry conference in Berlin tells DW how.



DW: You presented your research paper on edible films at the [Green and Sustainable Chemistry Conference in Berlin](#). Could you tell me, what exactly are edible films?

Tatsiana Savitskaya: An edible film is a thin layer, placed as a barrier between the food and the surrounding environment, which can be consumed. This is the covering for food. You can imagine this covering as the primary packaging. For example, look at an orange: it has two coverings, the external and the internal. The inner covering is similar to edible film.



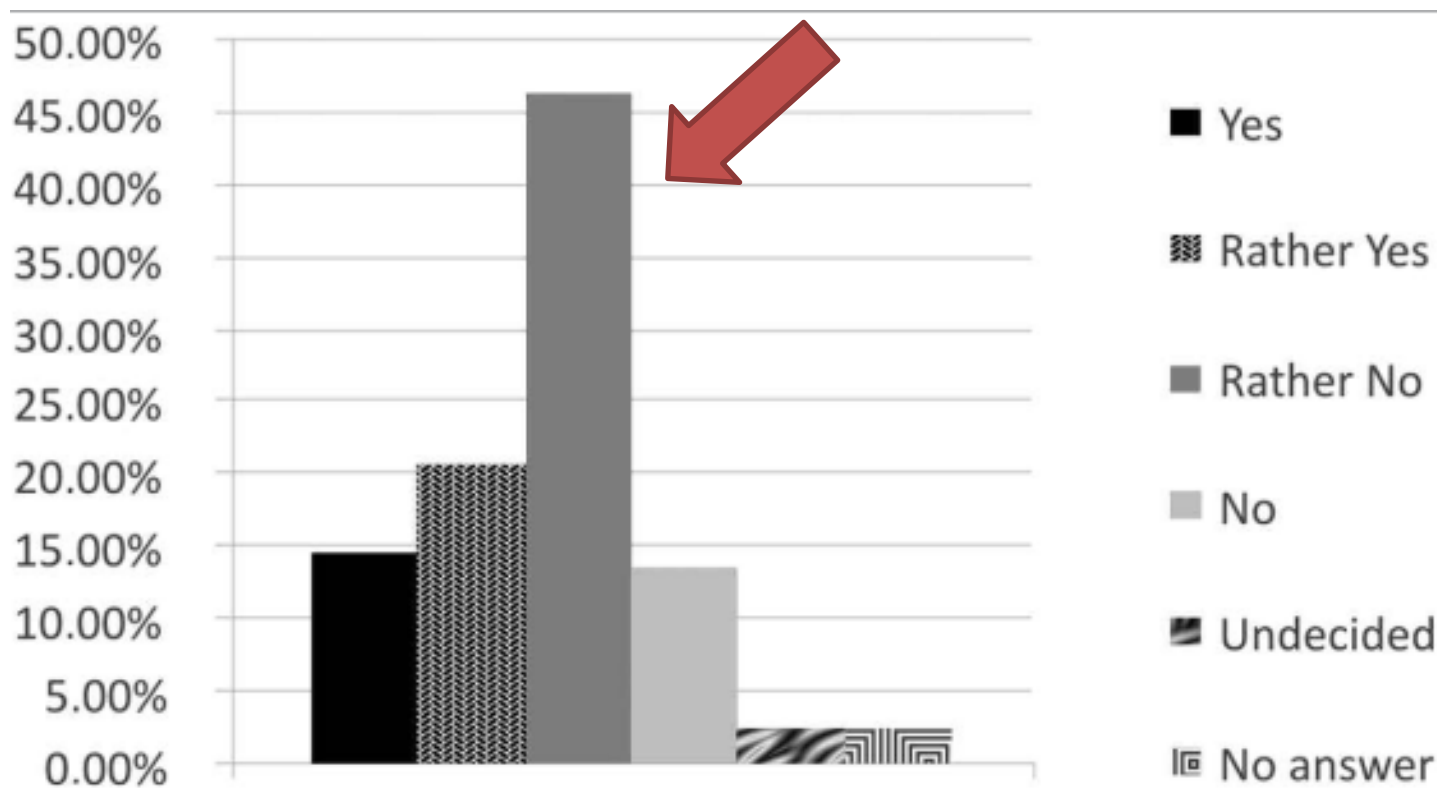
For example, we can use edible film for prolonging the shelf life for food, for protecting food from microorganisms. The main component of edible films is starch. And we can also add some natural additives into this edible film to give food a new taste, so for example we can add spiced curry or pepper into the film. It will be great because the combination of curry and pepper is very useful in the fight against cancer. In this manner we give food new functions.

What is the range of food that edible film could be used for?

Green and Sustainable Chemistry Conference in Berlin, April 2016

Full text: <http://www.dw.com/en/edible-film-the-future-of-eco-friendly-packaging/a-19165362>

Are consumers ready?

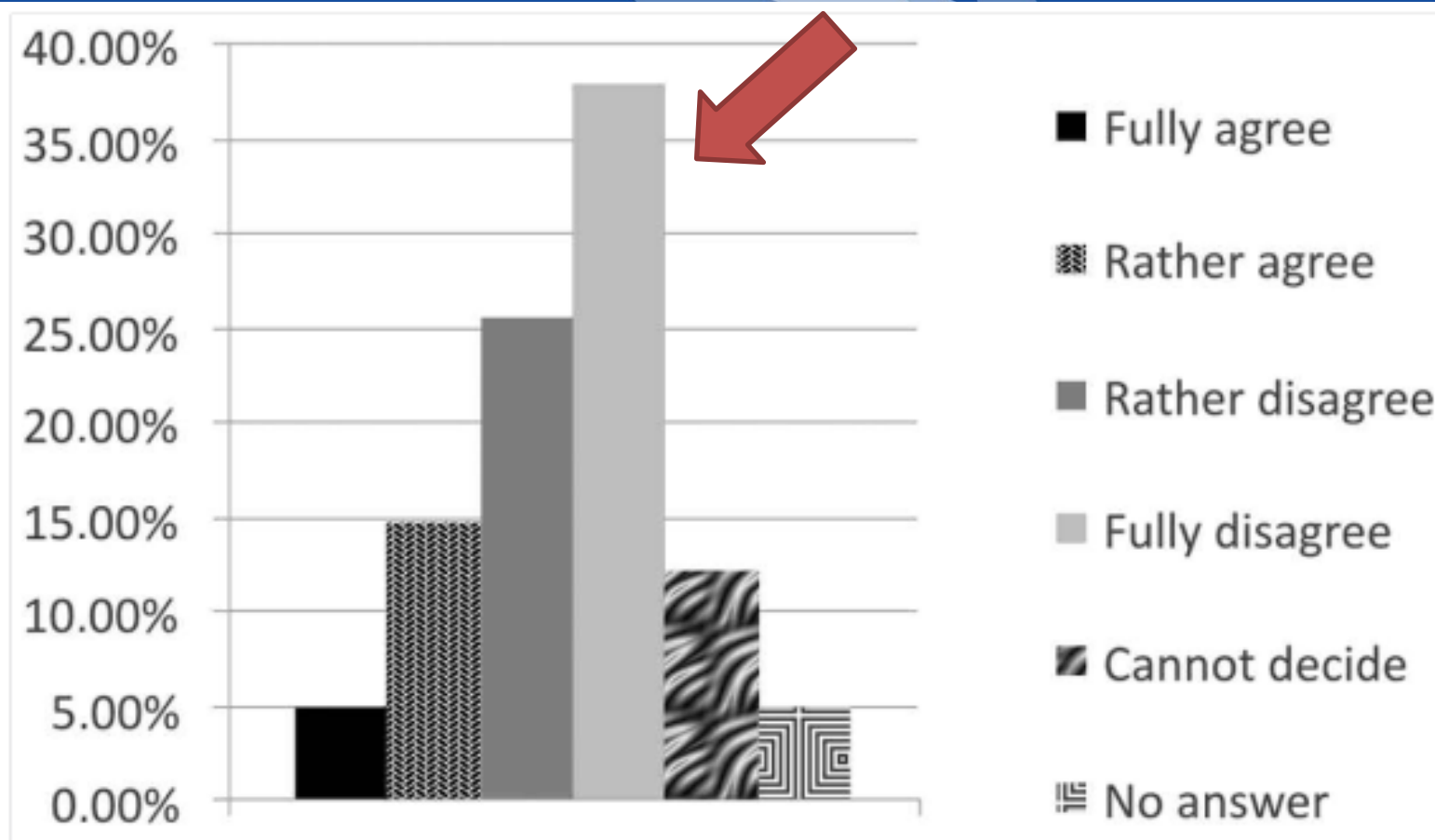


Are you familiar with the nature of edible coatings?

S.Pashova et al. Edible coating in Food Industry Related to Circular Economy/ Quality: Access to success, vol.19, number 166/October 2018.

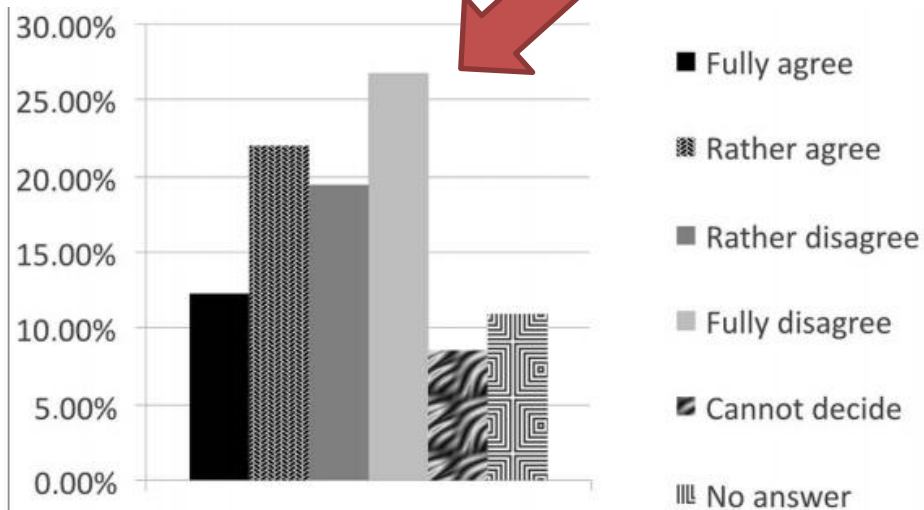
University of Economics – Varna, Bulgaria

Are consumers ready?

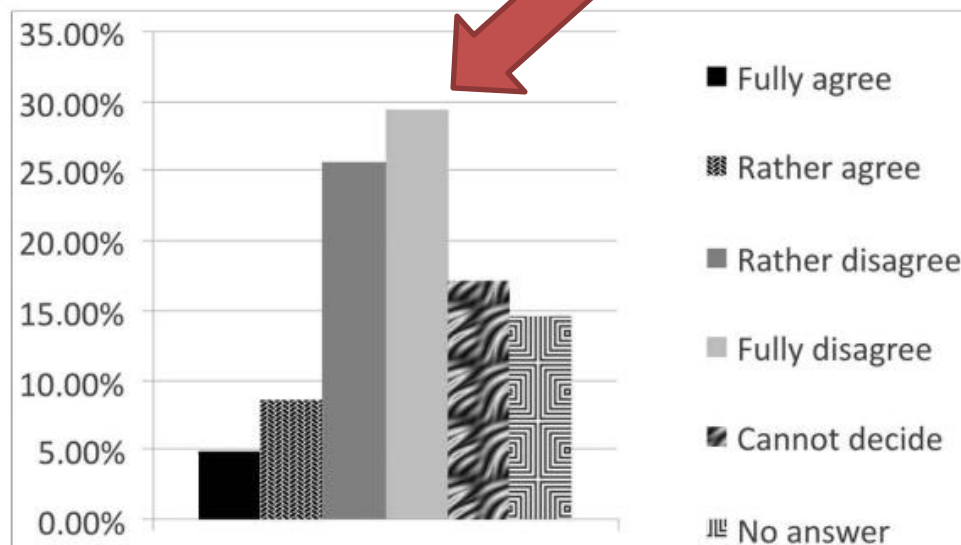


Agreement with the statement
"I would rather consume foods with edible coatings"

Are consumers ready?

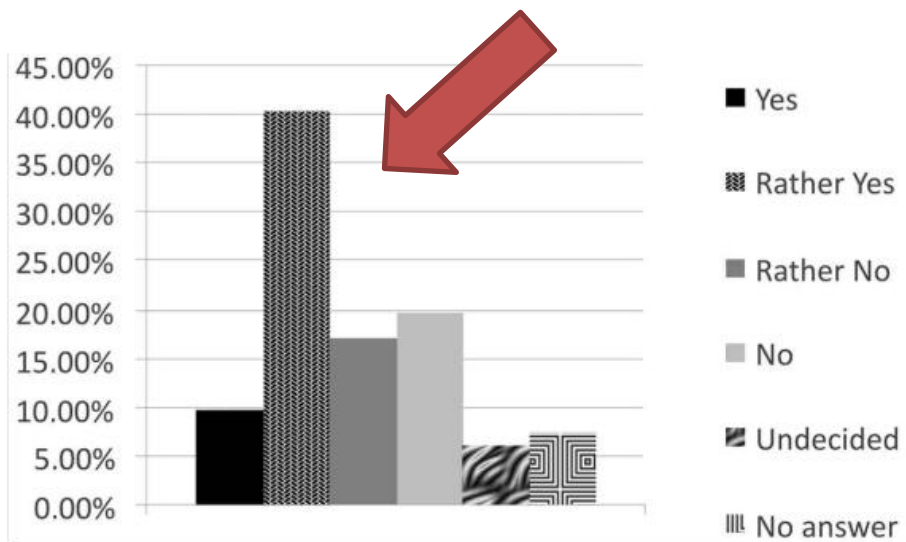


Agreement with the statement "I would buy foodstuffs with edible coatings, if their prices do not differ substantially from those we now buy"



Agreement with the statement "I would buy foodstuffs with edible coatings, regardless of price"

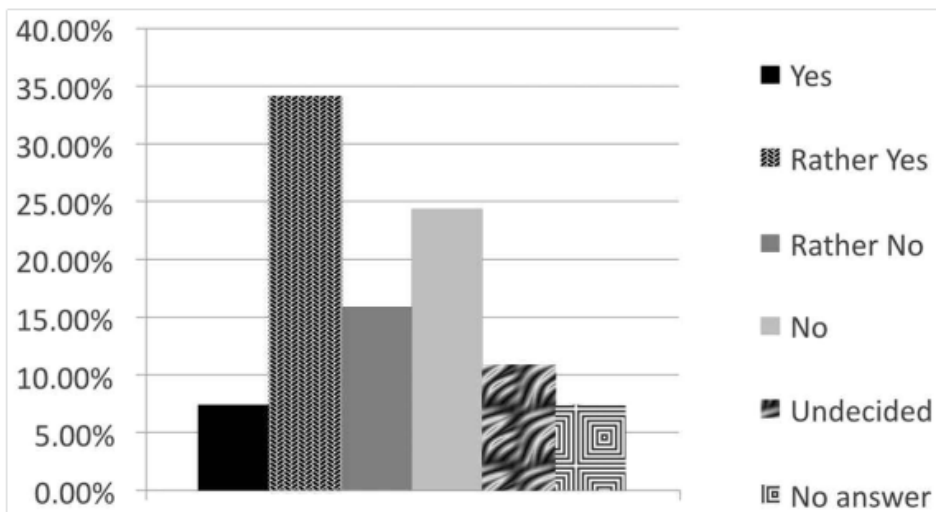
Factors influenced on consumers choice: presentation as an eco-innovation, creation of waste-free environment



Influence of the fact "the producer of foodstuffs with edible coatings generates a negligible amount of waste or collects its industrial waste separately" on consumer choice



How to attract consumers?



Influence of the fact "the producer of foodstuffs with edible coatings has introduced eco-innovations"

- ✓ **Carrying out an advertising campaign to promote edible packaging materials in the world market not only as an alternative to traditional packages, special barrier, but also *as food products that improve the safety and taste of food eaten at the same time.***

Introduction of taste additives, vitamins, drugs, etc.



Keep smell



Edible films: instead of capsules



Is it hard to give a dog a pill? It can be easy!



- ✓ Organizing in Belarus and countries of the European Union of the industrial production of edible packaging films and coatings based on starch as *long-term strategy*
- ✓ Creation of the consortium for Horizon 2020 application as *short-term strategy*



- **Belarusian State University**
- **LLC “Borisov’s Plant of Plastic Packaging “POLIMIZ”**

Thank you for attention!

