

Food Safety and Nanotechnology



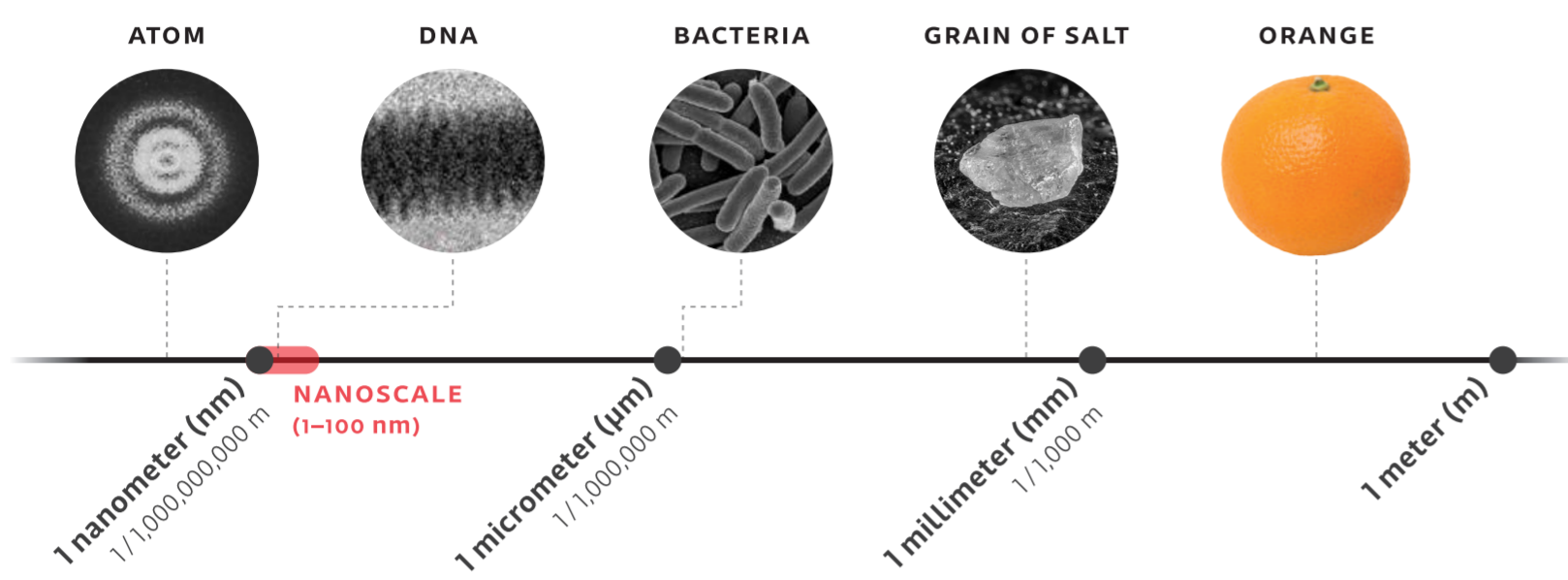
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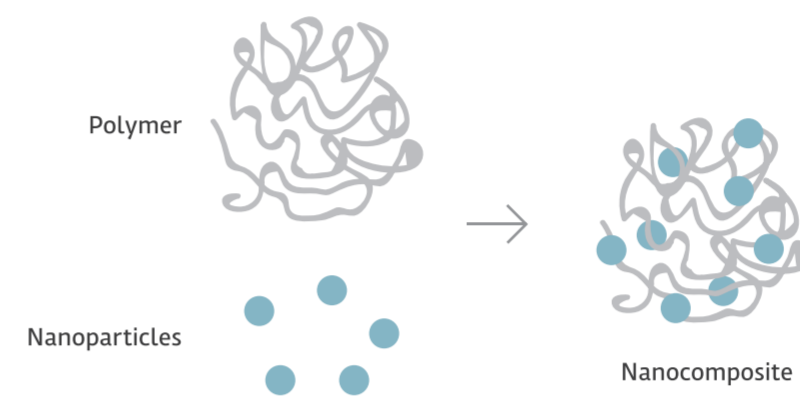
NANOTECHNOLOGY

Nanotechnology deals with the understanding, control and tailoring of unique properties of matter at the nanoscale, at dimensions between approximately 1 and 100 nanometers.



NANOCOMPOSITES

Nanocomposites are multicomponent materials having at least one component with nanoscale dimensions. With their unique properties mostly arising from large surface area to volume ratio, nanoparticles impart new functions to materials into which they are incorporated or they improve existing properties. Polymer nanocomposites are prepared by the incorporation of nanoparticles into polymeric materials.



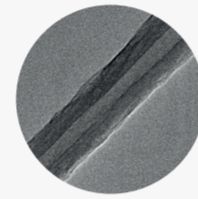
ADVANTAGES OF NANOCOMPOSITES

- Mechanical strength
- Low density
- Heat resistance
- Flame retardance
- Barrier properties
- Chemical resistance
- Corrosion resistance
- Conductivity

Active Food Packaging for Food Safety

Contrary to conventional food packaging materials that act only as a barrier between the food and its environment, **active food packaging materials interact with the food through active components embedded into the packaging material and improve the shelf life and safety.**

50 nm

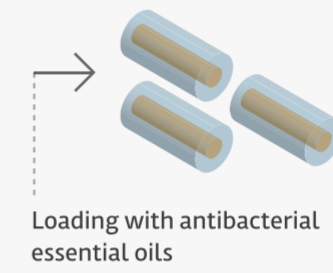


CLAY NANOPARTICLES

Aluminium silicate nanoparticles present an empty tubular nanostructure and are nontoxic.



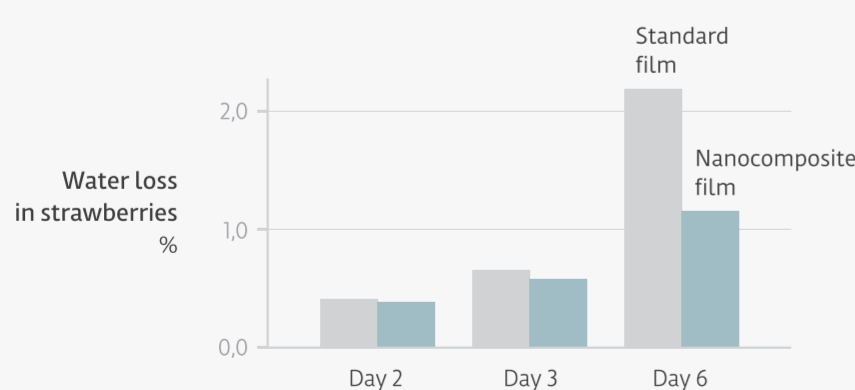
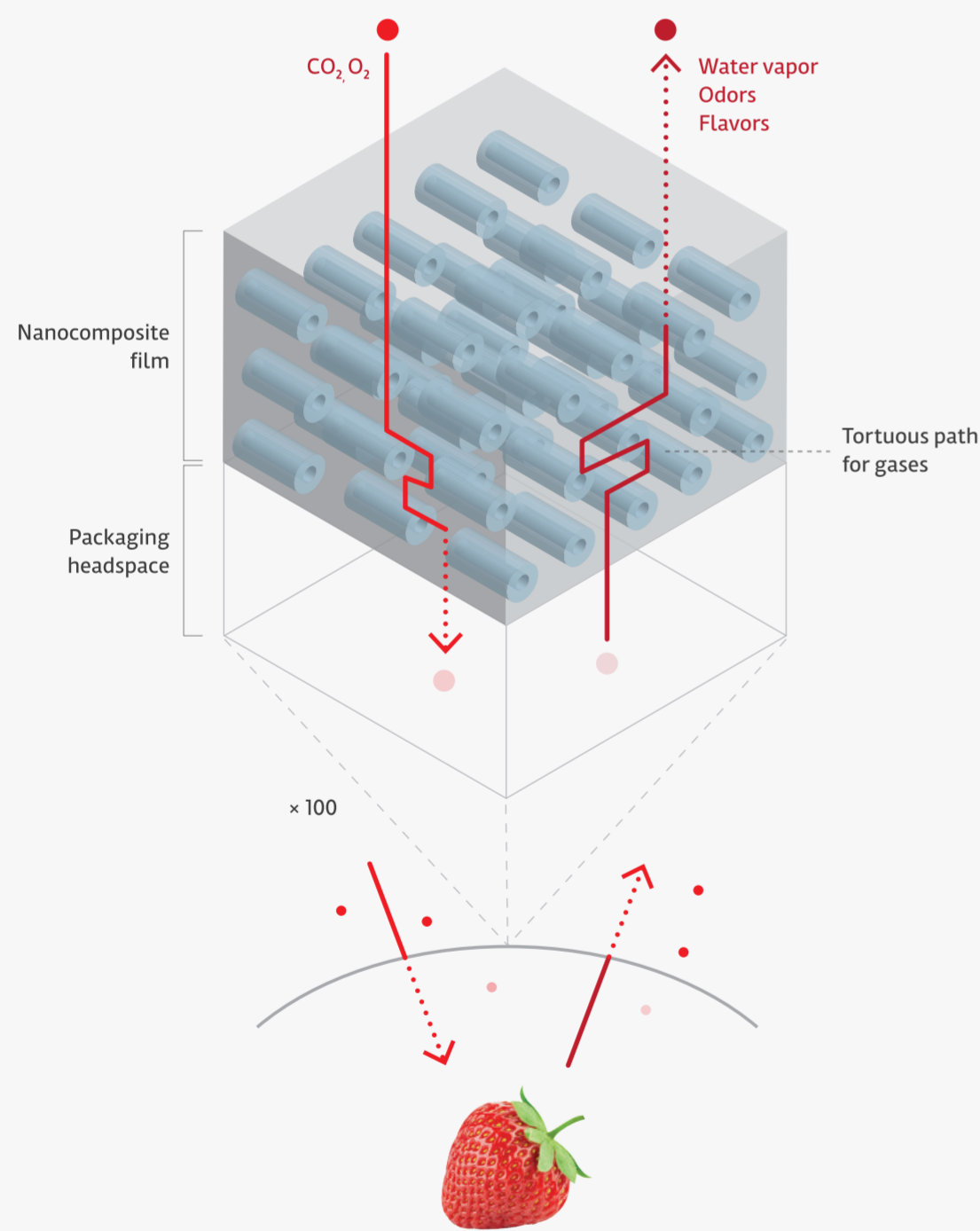
Empty clay nanoparticles



Loading with antibacterial essential oils

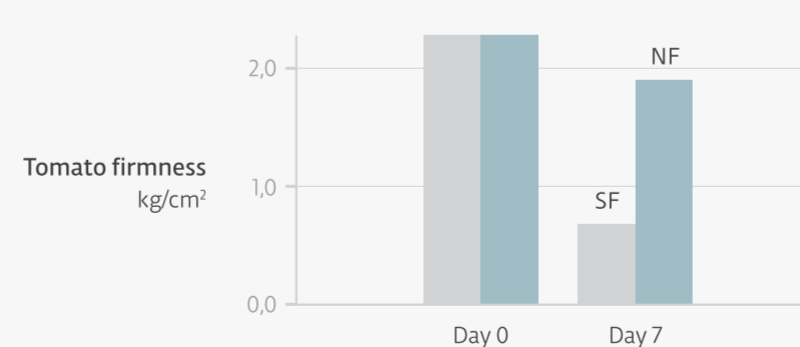
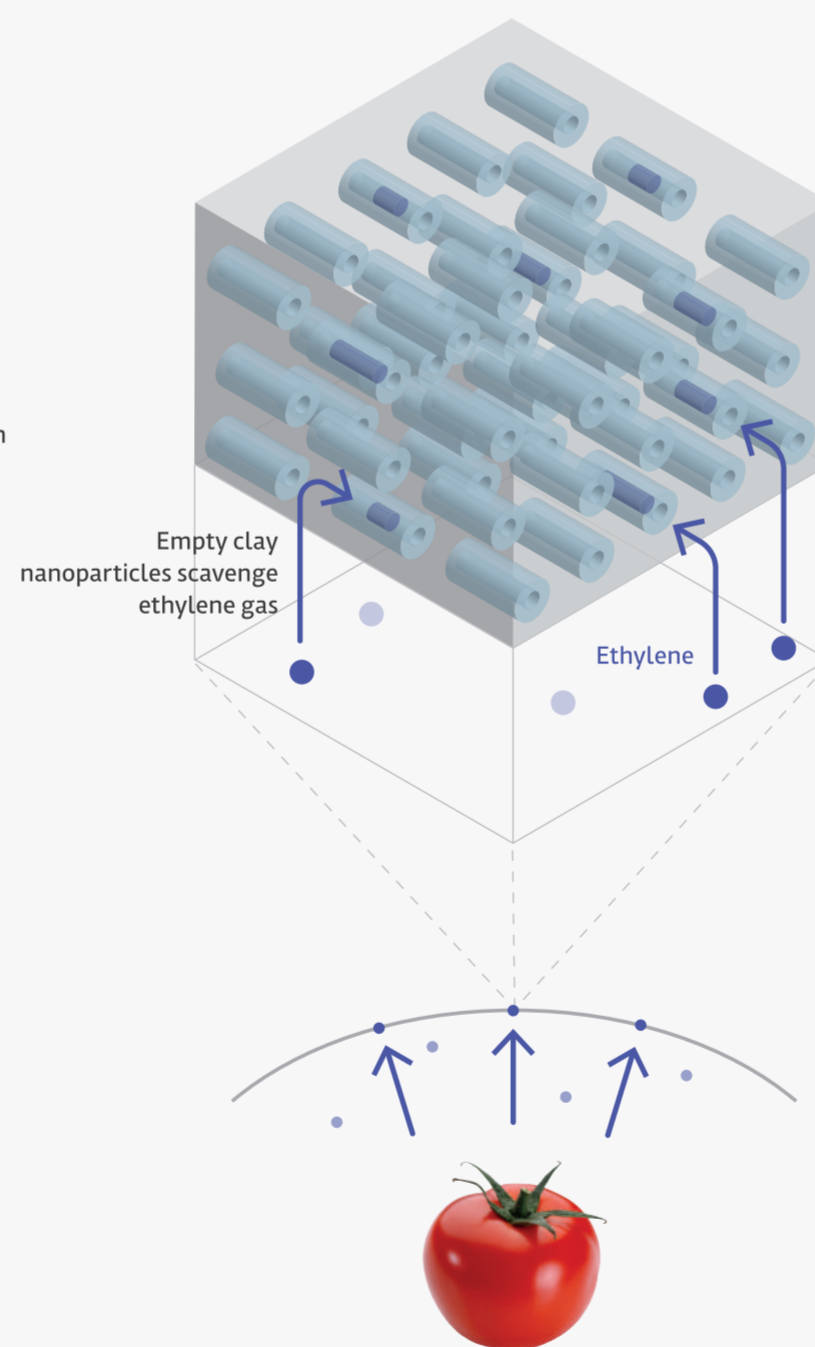
GAS BARRIER

Clay nanoparticles incorporated into standard food packaging films reduce permeability of films to gases such as O₂, CO₂ and water vapor. Resulting nanocomposite films prevent food spoilage through their gas barrier properties.



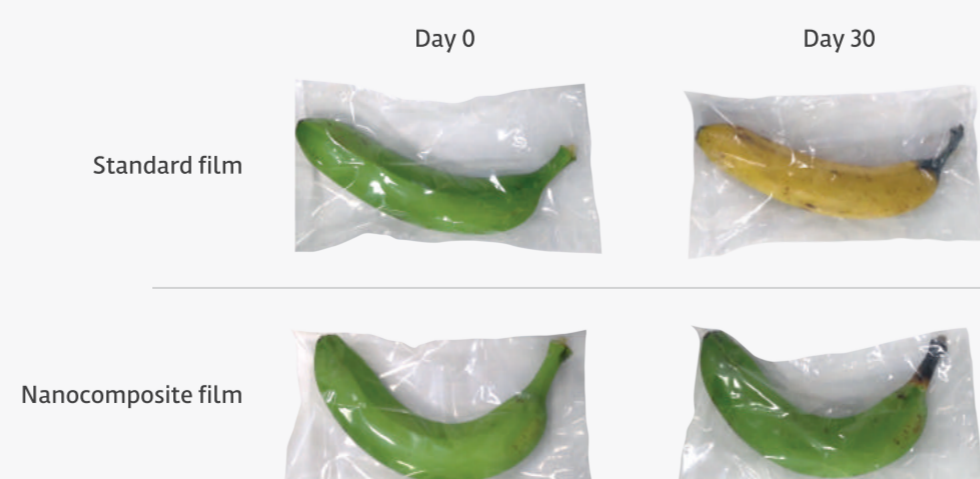
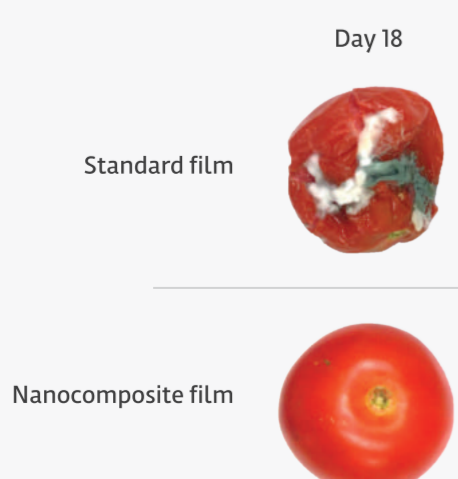
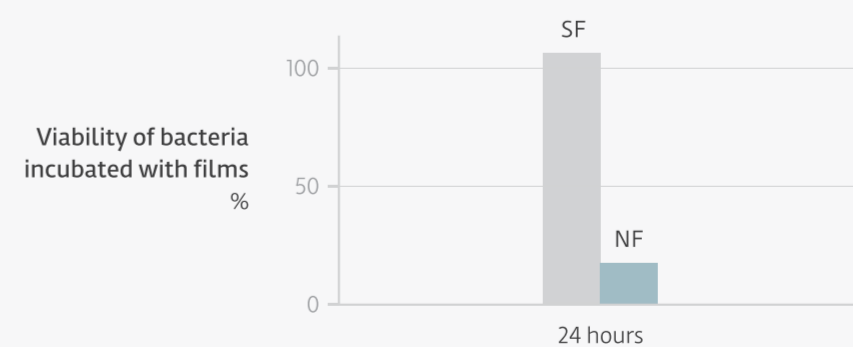
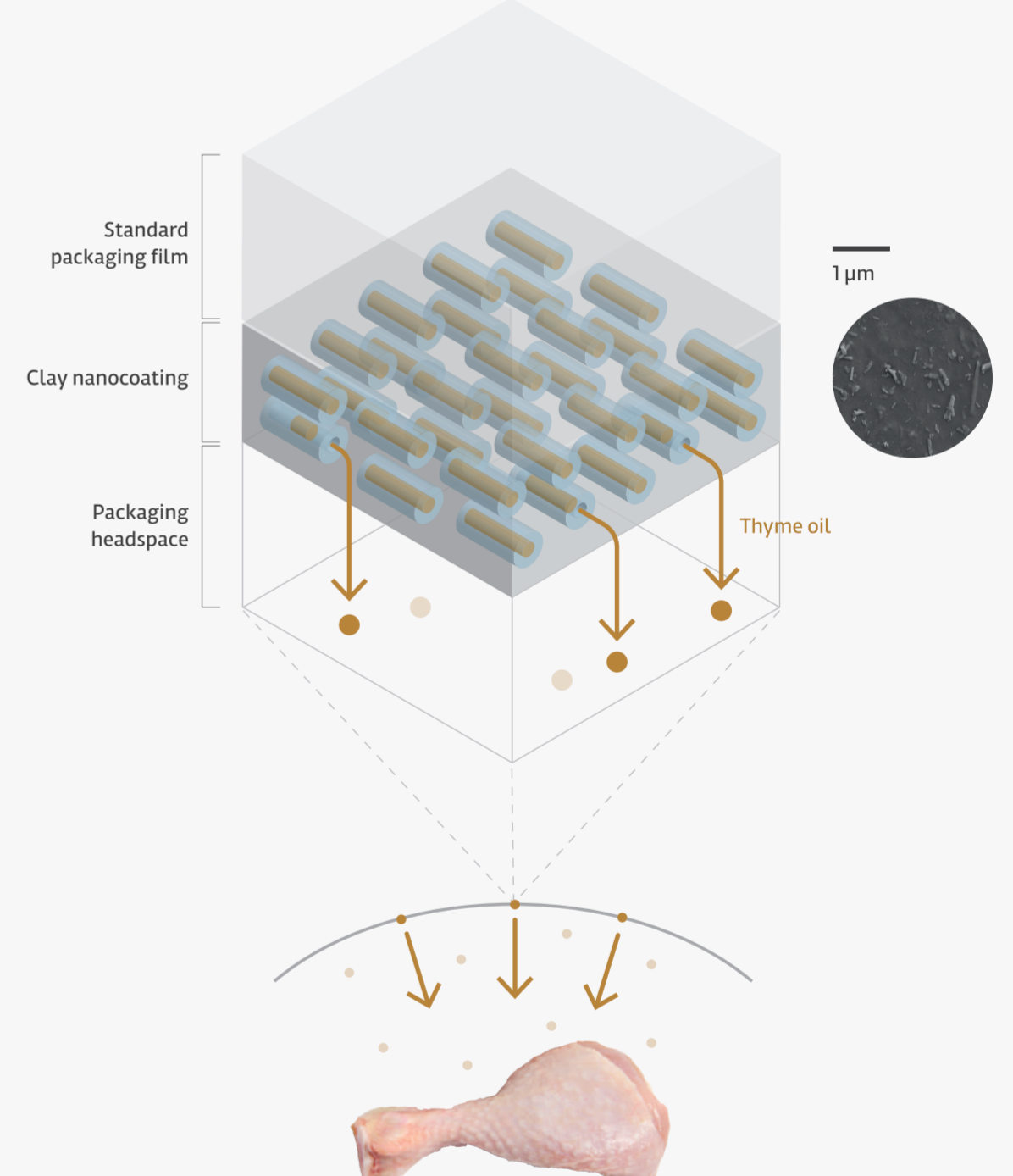
ETHYLENE SCAVENGING

Clay nanoparticles incorporated into standard films act as scavengers of the ethylene gas released by fruits and vegetables which is responsible for their spoilage.



ANTIBACTERIAL

Clay nanoparticles loaded with thyme oil are coated onto the inner surface of standard films. Resulting films present long-lasting antibacterial activity due to the sustained release of thyme oil from clay nanoparticles.



REFERENCES

Halloysite nanotubes/polyethylene nanocomposites for active food packaging materials with ethylene scavenging and gas barrier properties. Taş, C. E.; Hendessi, S.; Baysal, M.; Unal, S.; Cebeçi, F. C.; Menciloglu, Y. Z.; Unal, H. *Food and Bioprocess Technology*, (2017), 10 (4), 789-798.
Patent: H. Unal, F. C. Cebeçi, S. Unal, Y. Z. Menciloglu, "Food Packaging Material with Antibacterial, Ethylene Scavenging and Barrier Properties", Sabancı University, EP2965623A1, US9332751.

IMAGE SOURCES

Atom: *Phys. Rev. Lett.* 110, 213001
DNA: *Nano Lett.*, 2012, 12 (12), pp 6453-6458
Bacteria: Rocky Mountain Laboratories, NIAID, NIH