

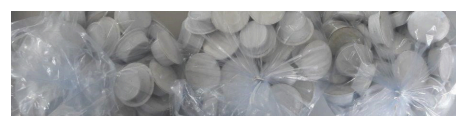
NatureWorks | Field Study Industrial Composting of Ingeo-based GEA Coffee Capsules



NatureWorks, Flo, and the Italian Composting and Biogas Association (CIC) teamed up to conduct a composting field trial with Ingeo™-based GEA coffee capsules in an industrial composting facility. The goal was to evaluate the compostability of the capsules over an 83 day time period.

WHAT WE TESTED

Ingeo-based GEA capsules from Flo designed to be compatible with A Modo Mio brewing systems. The capsules were filled with coffee, sealed, and either unused or used (brewed).



Unused, coffee-filled capsules



Brewed, coffee-filled capsules

THE COMPOSTING PROCESS

- CIC selected a composting facility treating the following types of waste: garden waste, plant tissue waste, waste bark and cork, and wood packaging.
- Capsules were put into specially designed vented testing bags used for monitoring the disintegration process.
- The bags are filled with a mixture of 2/3 shredded green-waste and 1/3 compost, adding up to 1% by weight of the biopolymer to be tested.
- A total of six bags were prepared – three containing unused coffee capsules and three containing used (brewed) coffee capsules.
- Capsules underwent 20 days of active composting where the bags were buried inside a static, aerated compost windrow, operated at 65°C (149°F) for 10 days and then at 60°C (140°F) for another 10 days. Moisture levels were maintained at 46%.¹
- These bags then cured for 65-70 days in windrows maintained between 50-55°C (122-131°F).¹
- Bags were recovered from the windrows (both active and curing) at regular intervals to monitor the disintegration process.
- After a total of 83 days, all bags are removed, emptied, and the contents were manually sorted to detect visible, non-degraded coffee capsules.



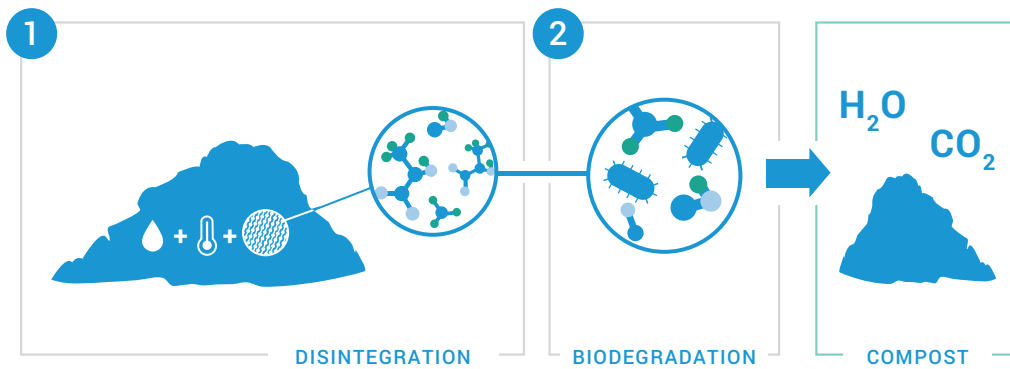
FINAL RESULTS CONFIRM COMPOSTABILITY

Both the unused and brewed capsules showed a disintegration rate between 98 and 100%, which is fully compliant with the EU standard EN13432 for compostable biopolymers.



¹ These conditions were chosen based on the EN13432 standard for assessing the amount of disintegration of compostable plastics

COMPOST CERTIFICATION ACCOUNTS FOR ALL STEPS IN COMPOSTING PROCESS



There are clear pass/fail criteria for each of the three main requirements for compliance with the following standards: ASTM D6400, ASTM D6868, and EN13432.

1. Disintegration

>90% of fragments must be less than 2mm in size

2. Mineralization/ Aerobic Biodegradation

Minimum of 90% conversion to CO₂

3. Safety of Final Compost

- Heavy metals
- Ecotoxicity

Ingeo biomaterials undergo a 2-step degradation process during composting. First, disintegration occurs when the moisture and heat in the compost pile fragment the long polymer chains into smaller polymers and lactic acid molecules. Second, through a process called biodegradation microorganisms in compost and soil consume the polymer fragments and lactic acid as nutrients. These two steps result in carbon dioxide, water, and compost.



ABOUT THE ITALIAN COMPOSTING AND BIOGAS ASSOCIATION (CIC)

CIC was founded in 1992 and its mission is to enhance and recycling and prevention of waste, enhance compost quality and perform technical training for composting sector and assist government entities in improve biowaste recovery. CIC started in 2006 a certification scheme for biodegradable materials. Today the "compostabile CIC" certification is recognized in Europe.



ABOUT NATUREWORKS

NatureWorks is an advanced materials company offering a broad portfolio of renewably-sourced polymers and chemicals. Naturally advanced Ingeo™ polymers are valued for their unique functional properties and used in the packaging, fibers, and durables markets. Vercet™ lactide-based solutions help innovators realize significant, measurable performance and cost advantages in the C.A.S.E. markets. Headquartered in Minnetonka, MN, USA, NatureWorks has a 150,000 MT/yr production facility in Blair, NE and a dedicated Ingeo Applications Development Facility in Savage, MN. NatureWorks is jointly owned by PTT Global Chemical and Cargill.



ABOUT FLO S.p.A.

Flo is a historic brand in the production of food packaging and cups for automatic distribution. The company, based in Fontanellato (Parma - Italy), was founded in 1973 by Antonio Simonazzi. While maintaining a strong link with the territory it belongs to, Flo is a well-recognized, and respected multinational company in the retail, vending, hotel, restaurant, and café sectors. Despite being a family-owned business, Flo has achieved considerable growth via their dedication to developing innovative, efficient and sustainable solutions.