# The role of used coffee grounds in BioEconomy

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- Many of us depend on coffee to fuel our early morning meetings, mid-afternoon or all-night study sessions
- Words “coffee” and “fuel” are half-jokingly synonymous
- More than 9 million tonnes of coffee is produced annually around the world → 24.660 tonnes of coffee per day
- Once we brew it and use it, an awful lot of waste is created → the vast majority ends up in landfill

- Serbia is 21st country in the world by consumption of coffee per person → 5 kg of coffee per year per person
- This means we use 36.000 tonnes of coffee per year of which 80% (29.000 t) is valuable coffee grounds residues that we throw on landfills
- Sustainable development should be prioritized → the development of techniques for giving additional value and reusing this type of residues should be also applied commercialy

# Used coffee biomass pellets

- Used coffee grounds can be used to turn waste from local instant coffee producers – *Grand kafa, Doncaffe, Bonito i C kafa* – and local caffeterias into biomass pellets for power generation, as well as residential heating using trendy biomass burners

- These coffee residues burn more cleanly and contain 50% more energy than traditional wood pellets because of higher caloric value → energy value of coffee pellets is 7,5 kWh/kg

- It can be produced at 10% below market trading price of biomass pellets because the coffee residues are free
- From 1 kg of coffee we can get 850 g of pellets that are safe and without any serious enviromental impacts or smell during combustion
- When compared to convencional woody fuels coffee pellets emmit less $CO_2$, burn hotter and longer, ignite quickly, are more cost effective and are manufactured from locally sourced waste coffee grounds

# Vermicomposting coffee

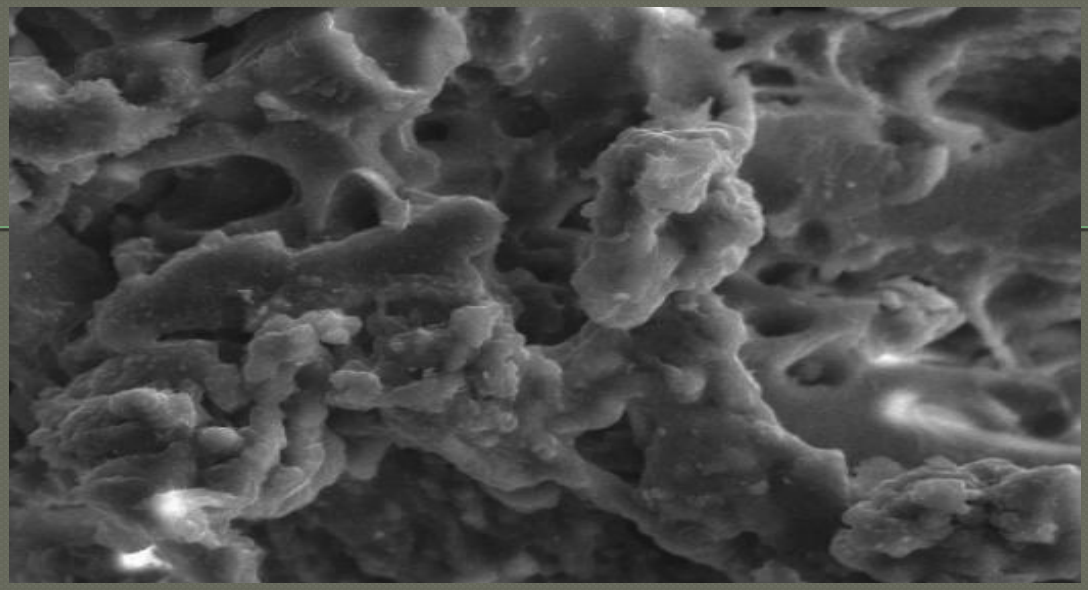
Vermicomposting, which is composting with the aid of earthworms (*Eisenia foetida*), is a viable, convenient way to turn a portion of used coffee into useful resources for plants and soil while reducing its environmental impact

- From 1 t of coffe we can get 730 kg of vermicompost very rich in nitrogen, nutrient vital to plants
- 30 kg of conventional vermicompost costs up to 20 euro and are considered as premium quality compost
- 20 kg of coffee waste turned into vermicompost costs from 3 - 5 euro → this means the economic potential in Serbia is cca 77.000 euros only from this kind of residues

# Soaking up heavy metals

- Waste coffee is effective at soaking up harmful heavy metals such as chromium, copper, nickel or lead which often leak out of chemical plants, farms or factories and cause significant damage

- In specific lab conditions waste coffee has been reported to remove up to 91% of heavy metal ions from solution → these basic research that shows potential environmental benefits have to yet be applied in commercial use



- Coffee grounds can be excellent natural adsorbent for heavy metal removal from aqueous solutions, specialy landfill wastewater, which is a very big problem in Serbia
- It's surface is not smooth, but full of cavities → these cavities can be characterized as channels onto the surface of adsorbents instead of pores, given the small surface area

- Also, the regeneration step of these adsorbents is easy
- They can be regenerated by desorption at low cost if required → they are easily regenerated by a washing solvent since the interaction between the pollutant and adsorbent is driven mainly by electrostatic, hydrophobic and ion-exchange interactions
- The desorption side of the process gives the pollutant in a concentrated form and restores the material close to the original condition for effective reuse with no physical-chemical changes or damage

# Other uses of exhausted coffee grounds

- Like most plant seeds, the coffee bean contains a significant amount of oil (15 – 20 %) which can either be squeezed out or chemically extracted → *hexane extraction*

→ Extracted oil can then be converted into biodisel (biofuel)

- Coffee contains a number of chemicals that, when isolated and purified, can serve very specific uses

- Examples include *chlorogenic acid*, a food additive that slightly lowers blood pressure, *trigonelline*, which helps prevent and treat diabetes and central nervous system diseases, *polyhydroxyalkanoates*, which are used to make bioplastics, and a wide range of antioxidants which can be used in healthcare or added to fuel to lengthen their lifetimes

- Used coffee grounds can also be used to keep snails away from plants

# Sustainability

| Ecology | Society | Economy |
| --- | --- | --- |
| - Reducing greenhouse effect<br><br>- Wastewater treatment<br><br>- Reducing pollution from soil<br><br>-Enhancing soil fertility<br><br>- Saving forests | - Creating new jobs<br><br>- Local farmers would have access to premium quality compost – high quality yields<br><br>- Health benefits<br><br>- Decentralization | -Opportunities for local farmers to buy low-cost premium quality compost<br><br>- Cheaper biomass for heating<br><br>- Avoiding costs from sanation of enviormental pollution |

# THANK YOU FOR YOUR ATTENTION