

## Spent Coffee Grounds: Trash to Treasure

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### SUMMARY

Spent coffee grounds (SCG) are the result of brewing coffee, and are the final product after preparation of coffee. Despite having several highly-desirable chemical components, used coffee grounds are generally regarded as waste, and they are usually thrown away. Hence there is an urgent need for practical and innovative ideas to use this low cost SCG and exploit its full potential increasing the overall sustainability of the coffee agro-industry.

### INTRODUCTION

Coffee is one of the most consumed beverages worldwide and the second most traded item after petroleum (Murthy and Naidu, 2012). It is a day-to-day product used in almost every household. Every day, around 2.25 billion cups of coffee are consumed around the world. Spent coffee grounds (SCG) are the residue obtained during the brewing process (Cruz *et al.*, 2012). Spent coffee grounds (SCG) are bio-waste, whose annual generation amounts to 15 million tonnes (Kamil *et al.*, 2019). Despite having several highly-desirable chemical components, these are generally regarded as waste and they are usually thrown away or composted. Spent coffee grounds are usually disposed of either in landfill sites or as burning fuel in boilers in the coffee industry. This solid residue has an additional disposal problem as it can be used for the adulteration of roasted and ground coffee. Spent coffee grounds (SCG) contain large amounts of organic compounds (i.e., fatty acids, lignin, cellulose, hemicellulose, and other polysaccharides) that can be exploited as a source of value-added products. Hence there is an urgent need for practical and innovative ideas to use this low cost SCG and exploit its full potential increasing the overall sustainability of the coffee agro-industry.

### Chemical Composition of Spent Coffee Grounds

Chemical Component	Composition (g/100 g dry weight)
Moisture	9.40
Protein	13.50
Nitrogen	2.79
Fat	2.29
Carbohydrate	71.70
Cellulose	12.40
Hemicellulose	39.10
Lignin	23.90
Ash	1.30
Total dietary fibre	60.45
Insoluble dietary fibre	50.78
Soluble dietary fibre	9.68

(Arya *et al.*, 2021)

### Potential uses of spent coffee grounds

- Spent coffee grounds are used as compost as they contain several key minerals for plant growth — nitrogen, calcium, potassium, iron, phosphorus, magnesium and chromium. They may also help absorb heavy metals that can contaminate soil
- Spent coffee grounds are used as insect and pest repellents as certain compounds found in coffee, such as caffeine and diterpenes, can be highly toxic to insects. They are effective at deterring mosquitos, fruit flies and beetles.
- Spent coffee grounds are used to neutralize odors as they contain nitrogen, which helps eliminate a foul-smelling sulfur gas from the air when it is combined with carbon

- Spent coffee grounds are used to manufacture an innovative durable espresso and cappuccino cup which smells coffee. The spent coffee grounds are mixed with biopolymers, starch, cellulose, resins, wax and oils. The resulting composite material was biodegradable, light with the smell of coffee and the look of dark wood. Espresso and Cappuccino cups were made by a German company, Kaffeeform.
- Spent Coffee Grounds can also be used to produce fabrics. A new technology is developed by a Taiwan company to produce yarns from coffee waste. Fabric made with this technology has natural anti-odor qualities, dries faster than cotton and has better UV ray protection.
- Spent Coffee grounds have an ideal ingredient for textile ink. The grounds are mixed with vinegar, strained, and then cooked to let extra fluids to evaporate. The ink thus produced is used for printing t-shirts.
- Spent coffee grounds when blended with orange peels produced bioplastics which are biodegradable in some studies (Manasi and Rohith, 2019).
- Spent coffee ground is a source of biodiesel production, bioethanol production and as burning fuel in industries.
- It is a source of natural phenolic antioxidants and is used as a biomaterial in pharmaceutical industry, food industry and polymer industry.
- Furnitures are produced from spent coffee grounds and recycled plastics. The materials produced are extremely robust, waterproof and scratch resistant. It requires neither sanding nor finishing because of its matte finish.
- Spent coffee ground can be used to produce table lamps, floor lamps and bowls. These are natural, biodegradable and renewable. It conserves colour and smell of coffee.
- Coffee grounds can be utilized as an additive and lightening raw material in ceramic manufacturing for construction purposes. Incorporating 4 per cent of coffee grounds to the bricks causes an increase in the strength of brick.
- Coffee grounds could be reutilized as a secondary clay raw material to form adequate clay construction ceramics which could reduce the energy consumption of a building (Samuel *et al.*, 2016).

**Some of the brands and materials made out of spent coffee grounds are presented shortly here.**

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### Coffee Polymer

Coffee polymer is a material consisting of 30% coffee grounds and 70 other biobased raw materials. There are three versions available- Espresso polymer, Cappuccino polymer and Americano polymer. It is biobased and biodegradable. It is perfect for long- term products like chairs and trays.



### Coffee cups

To make the material, coffee grounds are collected, dried and mixed with biopolymers, starch, cellulose, wood, natural resins, waxes, and oils. The resulting composite material is biodegradable, light, with the smell of coffee and the look of dark wood.



### Coffee to burn pellets

Coffee to Burn pellets are pellets for a pellet stove made from waste materials- coffee grounds and sawdust. The pellets have a higher caloric value than ordinary pellets, emitting more heat, and contain 25 per cent more energy than other pellets, saving fuel and decreasing CO<sub>2</sub> emissions.



### S. Café Coffee Fabric

S.Café is made from a combination of used coffee grounds and polyester. In a low temperature, high-pressure and energy saving process, the coffee grounds are combined with the polyester yarn surface, changing the characteristics of the filament and adding properties like fast drying, UV-protection and odour control.



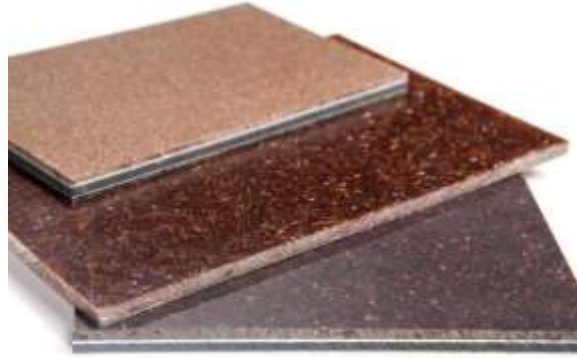
### Coffee panels

Coffee panels are composite materials produced from coffee grounds and a biopolymer, polylactic acid or polylactide. These composite materials incorporate a percentage of coffee grounds, which may vary between 60% and 70%, PLA, with and without the addition of any chemicals.



### Coffee Floor Material

This seamless floor comes in a matte finish and has a closed and resilient surface. It gives a warm feeling and a unique colour and pattern coming from the coffee grounds. Touch of nature is a floor covering made with a resin based on linseed oil, and can be binded with vegetable granules and chips, such as cork granules, bark chips, wood chips, but also coffee ground, to obtain a range of colours and patterns based on nature. These liquid biobased formulations are based on agricultural sidestreams, curing at room temperature to give resilient seamless floors, panel coatings, tabletops, countertops and furniture surfaces.



### CaffeInk

Dutch start-up CaffeInk developed an environmentally friendly ink as an alternative to black ink made from fossil-based carbon black pigment from coffee grounds.



### Coffee sneakers

Nat-2's vegan, unisex sneakers are made from recycled coffee, coffee grounds and coffee plants. The coffee material is applied to a base layer, giving it a smooth and fine feel. The coffee's texture remains visible, and you can smell the coffee. Depending on the shoe style, the material covers up to 50% of the shoe's surface.



Coffee industry even though produces a huge quantity of by-products, the research carried out in various parts of the world has proven that these by-products are of great value to replace plastics effectively and efficiently. It is also proving that the industry not only contributes to the sustenance of environment by cultivation Planters' World but also proves an eco-friendly and sustainable source of biodegradable by-products as alternative to plastics in the globe.

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