

Sustainable Management Methodology for the treatment of Spent Coffee Grounds (SCGs) in the Framework of Circular Economy

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Abstract

Coffee is considered the second largest traded commodity after petroleum and has been growing steadily in commercial importance, not surprising considering that it is the most popular beverage in the world [1]. According to the International Coffee Organization (ICO) [2], coffee production (by all exporting countries worldwide) is estimated up to 148 million bags (each bag=60Kg), with world consumption estimated at slightly lower to 151.3 million bags, which gives a global deficit of 3.3 million bags [2]. Statistics regarding Coffee in Cyprus given by the ICO for year 2015, shows a total consumption of 86,000 bags [2]. Per capita consumption is increasing the last 10 years, from 4.53(Kg) for 2012 [3] to 6.1 (kg) for 2015 [2]. In reverse series the per capital consumption is: Finland (9.6 Kg)>Norway (7.2 Kg)>Netherlands (6.7Kg)>Denmark (5.3 Kg)> Germany (5.2 Kg)>Italy (3.4 Kg)> France (3.2 Kg)>Spain (3 Kg)>Greece (2.4 Kg) > Cyprus (2.1 Kg). Coffee imports in CYPRUS for 2015 (60kg bags) were 17312 for green coffee, 10450 for roasted coffee and 61339 for soluble coffee [2]. Also, Cyprus runs in the 4th place behind Japan, Italy and Portugal that pay the most for their coffee. Furthermore, data from the Statistical Service of Cyprus (on 2015) reports that there are 615 cafeterias and 515 coffee shops, which account more than 1100 establishments that produce SCG. A great amount of waste is produced from this famous commercial product, mainly of Spent coffee grounds (SCG), which refers to coffee grounds after they have been used. These are the primary coffee waste by product (45%) generated in coffee beverage preparation and instant coffee manufacturing, e.g. by the espresso coffee extraction process [4]. Within these processes, raw coffee powder is contacted with hot water or steam, under conditions which favour the release of aroma compounds and other coffee-bean constituents into the liquid [5]. Due to these processes, SCG has a high humidity content (80% to 85%), fine particle size, organic load and acidity [6]. Its' chemical composition (content in wt%) reveals a product rich in proteins (6.7-13.6%), oil (10-20%), lignin (25-33%), cellulose (8.6-13.3%), hemicellulose (30-40%), polyphenols (2.5%), caffeine (0.02%), arabinose (1.7%), galactose (13.8%), mannose (21.2%), ashes (1.6%), organic matter (90.5%), Nitrogen (2.3%) C/N ratio 22/1 [6] components, which are valuable if they are obtained from SCGs and used in other applications, such as in bio-fuels, compost, dietary fiber, bio-sorbents and enzymes, in bio-energy and in other food and health applications [7]. Possible methods of the exploitation and use of this waste have been investigated in recent years, emanating from the need of waste reduction and environmental protection. Until recently SCG had been discarded as solid waste and were considered not to have any commercial value [5].

Keywords:

Circular Economy, Spent Coffee Grounds (SCGs), Antioxidants, Compost, BioEnergy, Dietary Fiber, bio-sorbents, biochar