

BIODEGRADABLE PLANT BASED CAT LITTER FILLERS – RELEVANCE OF THE TOPIC IN BULGARIA

Silviya S. Radanova

Trakia University, Stara Zagora, Bulgaria

ABSTRACT: *The appearance of biodegradable cat litters is a regular stage in the development of human-nature relationships, an expression of our concern for the difficult survival of this tiny, dared to enter human settlements predator. The article analyzes the plant species used as a basis in cat litter to attract public attention to the problem of the ecological utilization of plant and animal waste. Biodegradable cat litter mats are one solution to how waste products from diverse industries and agriculture can be used to improve the welfare of our pets.*

Keywords: cat litter filler, biodegradation, plant species, pets welfare

1. INTRODUCTION

The domestic cat (*Felis silvestris catus*) has long been a part of our lifestyle with its unintrusive presence. It is proud to carry out its millennial mission as a small predator - to cope with rodent populations around barns and warehouses in human settlements (Vigne et al. (2004); Driscoll et al. (2007). The urban environment in cities increasingly imposes the difficult role of cats as pets that depend entirely on its owner (Palmer & Kasperbauer, 2018). Although the definition raises many ethical issues, dilemmas and conflicts, the number of households growing more than one pet increases (AVMA. 2012). It is true that keeping animals at home can be expensive and inconvenient, but for many people the benefits of living together are so significant that they outweigh the costs (Serpell & Paul 2011). Research shows that owners are highly attached to their satellites and invest significant resources in caring for them. Accompanying animals support a massive industry - in the US alone in 2014, estimated expenditure was \$ 58.51 billion for production of specialized foods, toilets and accessories, veterinary care and services (APPA 2014).

One of the main problems associated with the nurture of the species indoors is the places of excretion of its metabolic waste - cat litters. As an obligatory predator that feeds on meat, cat urine is highly concentrated, with high levels in urea, creatine, uric acid, sodium chloride, and electrolytes. When the cat's litter is not cleaned on time, the bacteria that break down its components begin to act in stages – at the beginning odor of ammonia appears, and subsequently the increasingly unpleasant sulfur compounds - mercaptans show up (Starkenmann et al., 2015). This is one of the reasons why cats are unwanted in shelters, chased away from home and even euthanized (Salman et al., 2000).

The history of cat toilets is the work of surveyors, biochemists and mining engineers, and of course, of coincidence. Until the middle of the last century, cats were kept warm only in winter, and the cellars were filled with ash from fireplaces or sawdust, which they used as natural toilets (Goodman, 2015). In Michigan in the winter of 1947, Edward Lowe (owner of an industrial absorbent company) changed everything. The cold winter conditions cause his neighbor to not use the frozen sand for a cat toilet and he solves the problem by giving it dry clay pellets. Receiving positive reviews of this accidentally discovered new cat litter filler, he is gradually turning it into business (Lowe et al., 1987). This is how the cat litter filler industry started, and naturally, the innovation in refining it. The first are made of clay (Fuller's Earth) with non-clumping particles. The next innovative step does dedicated biochemist Thomas Nelson, Ph.D (Nelson, 1991). He found that crude dried clays have highly absorbent properties and form lumps that retain moisture in them - thus creating clumping fillers for cat litter. It was not until 2014 that John Lipscomb (Repinski, 2014) - a chemist, who created an alternative 100% grass cat litter that does not emit dust, it is biodegradable, neutralizes smells, and does not clump.

This study aims to analyze plant species used as fillers in biodegradable cat litter, connect their morphology and histology with some of *their* physical and sensory properties, and to show that keeping cats indoors can be a pleasant and environmentally friendly activity that is financially sparing owners and improves the pet's quality life.

2. MATERIALS AND METHODS

In July 2019, 20 pet shops were randomly crawled on the territory of Stara Zagora and a survey was conducted on the types of fillers for cat litter. On-line information about the offered products in the big cities - Sofia, Varna, Bourgas, and Plovdiv was made. Primary information was collected for the territory of Stara Zagora - directly from the source: seller-consultants (in many cases with veterinary-medical education or having contact with clinical base). A short survey was also conducted with two standard questions: are there plant-based cat litters available, and if there are pellets in the store (mainly for rodents) - are buyers informed that they can also be used for cats? The online survey includes secondary data collected from Internet sites, and patents filed in the Google Patents system. The results obtained are interpreted from a botanical and biochemical view point.

Cited patent information is protected by US Constitution, US Patent and Trademark Office (USPTO), World Trade Organization (WTO), and at European level - by European Patent Convention (EPC). Other levels for patent protection are the Guidance of Paris Convention for Protection of Industrial Property (PIP) (1883) and Patent Cooperation Treaty (PCT) (1970), administered by World Intellectual Property Organization (WIPO) and covering more than 150 countries, with Bulgaria among them. The clauses and subparagraphs of these documents shall be updated periodically.

3. RESULTS AND DISCUSSION

Results of the survey, conducted on the territory of Stara Zagora and on -line reference for our country are summarized in Table 1.

№	Pet store	Address	Type of cat litter
1	Pet store	29 “ Tsar Simein“ Str.	Bentonite, Silica gel, Bentonite scented
2	Pet store „Friends“	42 “I.Garvanov“ Str.	Bentonite, Silica gel
3	Pet store	137 “Mayor Kavaljiev “ Str.	Bentonite, Silica gel
4	„City Tails “	177A “ Mayor Kavaljiev“ Str.	Bentonite, Silica gel, <i>Biodegradable soybean & corn pellets</i>
5	Pet store	129 “Tsar Ivan Asen“ Str.	Bentonite – natural and scented
6	Pet store	51“Parchevich “ Str.	Bentonite – natural and scented
7	Zooland	115 „, Kniaz Boris“ Str.	Bentonite, Silica gel
8	Veterinary pharmacy	49 “Geo Mllev “ Str.	Bentonite, Silica gel
9	Pet store	139 “Hristo Botev “ Str.	Bentonite, Silica gel, <i>Pellets from Juniper, cellulose, fiber & bulk</i>
10	„Vereia Vet“	43 “D. Naumov“ Str.	Bentonite, Silica gel
11	Pet store	35 “Sava Silov“ Str.	Bentonite, Silica gel, Bentonite scented
12	Pet store	75 “Mayor Kavaljiev “ Str.	Bentonite, Silica gel
13	Pet store „Tedy“	9 „,Capt. P. Voivoda“ Str.	Bentonite, Silica gel, Bulk for rodents

14	„Zoostop „ Pet store	23 “A. Batenberg “ Str.	Bentonite – natural and scented , <i>Biodegradable soybean & corn pellets</i>
15	Pet store „Effect“	31 “Iskar“ Str.	Bentonite – natural and scented , Silica gel , <i>Biodegradable fiber pellets</i>
16	Pet store “Lorka“	4 „Slavianski,, Blv.	Bentonite – natural and scented , Silica gel – natural and scented, <i>Biodegradable soybean, corn, green tea & coffee pellets</i>
17	Pet store „Luki“	60 “Avgusta Trajana“ Str.	Bentonite, Silica gel <i>Biodegradable – 5 types + bulk</i>
18	Pet store „Feniks“	9 “Stara planina“ Str.	Bentonite, Silica gel + <i>Biodegradable soybean</i>
19	Pet store “D-r Kollev“	96 “Tsar Ivan Shishman“ Str	Bentonite, <i>Biodegradable – from maize + bulk</i>
20	„Royal pets”	77 “D. Naumov“ Str	Bentonite, <i>Biodegradable – pellets from coniferous and deciduous species + soybean</i>

Table 1. Pet stores visited

The analysis of available cats toilet in pet stores visited shows three main types of cats litter filler:

1. Clumping - from natural clays (sodium bentonite) - natural or scented
2. Non-clumping - from silica gel or calcium bentonite - natural or scented
3. Biodegradable (plants based) - clumping in different levels - containing parts of stems, leaves, seeds and fruits; in the form of pellets or granules, natural or flavored, of the following plant species: pine, juniper, cedar, soybean, wheat, maize, coconuts, coffee, green tea, bamboo, citrus fruits, box and recycled paper (pulp).

A survey conducted in the Stara Zagora sales network reveals that biodegradable cat toilets are increasingly being used (50% of pet stores already offer one or more items), although they are sought after by a small number of customers. On-line space in our country offers more choice related to established import brands. The author is not a specialist in the field of market economy and does not comment on prices, but is aware of one of the basic principles of marketing - that the situation on the

internal market must correspond to the situation on external one. This makes the quality items too expensive, which significantly limits the ability to house more pets in homes, shelters, etc.

The ubiquitous replication of biodegradable nature of plant based cat litters seems to contrast to those based on classical clays. In fact, both types of fillers have natural origin. Different types of clays come from volcanic ash and if decomposed, today there would be no fine porcelain products, stable buildings, steel and foundry, wine, etc. (Murray, 2000). Plant residues break down over for different periods of time, but in any case it is less than the disintegration of artificial materials. Along with organic waste, they can be used as a compost in the garden once more (MOEW, 2010).

It is well-established practice in the developed countries to produce statistics every year, incl. to the consumption of mineral deposits, which, like fuels, are not inexhaustible (Hosterman, Patterson, 1992). Current study on the consumption of cat litters (2014) shows, that 72% of buyers prefer bentonite clay, 16% non-clumping clay, 9% silica gel, and 12% buy plant-based toilets. One of the major reasons for the biodegradable cat litters appearance is the environmental impact of their precursors – the clay based litters. The way clay is extracted - in strips that disrupt habitats - is discussed, as well as the fact that it is not biodegradable. According to a US Geological Survey in 2011, of the 4.68 metric tons of bentonite excavated, 1.11 metric tons are involved in the production of cat litter and the used clay waste is dumped directly into landfills no recyclable.

From botanical view point, plant sources used as fillers for cat litter can be divided into four groups:

1. Stems

- from woody species – waste bark and wood are used

In tree species, cellulose cell walls are thickened and hydrophobic waxy - like compounds are postponed between them: suberin (45%), lignin (27%), tannins (6%), *waxes* (5%) and other substances (5%), summarized as cork (Silva et al., 2005). Cork is an inert material impermeable to gases and water, also retains neutrality of taste and odour, and does not absorb odours. If the wood is from **coniferous** (pine, spruce, cedar, juniper, cypress), there are resin-filled essential oil cavities situated between the cells. Also available on the market are pellets of **deciduous species** - beech, oak etc. Raw bark and wood contain tannins, polyphenols, sterols, organic acids and flavonoids (Ciurlea et al., 2010; Raju et al., 2007). For both wood types, the pellets must be thermally treated and dried several times to remove moisture and bioactive substances that may be toxic to cats. When used, the pellets turn into sawdust, swell, but do not stick together, easily separated from the paws without risk of ingestion.

- from grass species - grasses (*Poaceae* Family) – stems and rarely leaves

For bedding, the stems (the straw) of cereals after harvesting are used - wheat, rye, barley, oats, which are dry and easy to process due to the thin cellulose cell walls. Indoor cats spend up to 30% of their day caring for their fur, licked hair is often collected in balls and causing constipation in the digestive system (Benjamin, 1976; Panaman, 1981). Outdoors, cats instinctively orient themselves to

the leaves of cereals, which normalize their peristaltic. Similar will be their reaction at home with stomach problems as well. An inappropriately selected and poorly processed cereal substrate in the cat's toilet can become a problem, especially for small kittens. Cat litters, made from recycled paper (cellulose) are not among the most preferred because of the high cost and frequent replacement necessity. Cellulose fibers absorb water and swell, but does not form lumps.

The water content of the leaves is much higher, as is the amount of biologically active substances, so they are not a preferred substrate for cat litter, but are mainly used for feed. An exception is made for leaves of species grown massively in culture for other purposes - cosmetics, medicine, etc., which are leather (tea) or fleshy (aloe) and unsuitable for animal feed.

2. Fruits and fruit parts - the dry woody parts of the fruit are used - pits, shells, pods, sunflower husks, etc. (nuts, peanuts, soybean and bean casings) made from mechanical tissues, named sclereids. They are dead at maturity and have corky cell walls. Cat litters, made from this material, is not clumping. The pulp, obtained from the processing of fruits and vegetables - tomatoes, beets, oranges, a rich of starch.

3. Seeds and seed parts - mainly seeds of grasses and legumes are used (*Poaceae* & *Fabaceae* family) - wheat, maize, soybeans, etc., grown as major crops in the temperate zone. The seeds are rich in starch, which captures moisture and easily forms lumps (Bietz & Lookhart, 1996; Vaughn et al., 2011). It has been found that during the production process maize pulp can become infected with molds (Park et al., 2018), which, even treated, retain their toxicity in the cat toilet. Often the core and whole cob of seeds are used for production of cat litter.

4. Tropical species - depending on the latitude and specificity of the crops grown, cats' litters include various parts of native plant species, such as: Genus *Coffea* (Coffee) , *Cocos nucifera* (Coconut) - fruit sheaths are used; Genus *Bambusa* (Bamboo) - stems are utilized, Genus *Citrus* (Citrus) - a citrus slurry containing residues from the fruit wall, seeds and stems are put-upon.

4. CONCLUSION

From botanical view point the use of different plant parts determines the physical and sensory properties of the cat's litter filler. When plant organs, containing cellulose or cork (woody and grass stems) are used for this purpose, the filler has absorbent properties but does not clump and absorbs the smell to varying degrees. The large amount of starch in the seeds gives clumping properties of the filler.

Analysis of plant sources reveals another important pattern - local, low-cost waste products from different industries are used. The usage of native species should take into account the seasonal cyclicity of crops in the temperate zone. As an EU member, Bulgaria is involved in the problem of waste management and recycling (Uzunov 2018). Every year various fields of production, such as agriculture and forestry, aquaculture, production of ethyl alcohol, textiles, tobacco, beer, furniture and canning, etc., emit tens of tons of plant biomass (RIEW, 2011). At the same time the latest annual data from European Pet Food Industry Federation (FEDIAF, 2018) shows that pet ownership across Europe

remains high, with an estimated 80 million European households owning at least one pet. For Bulgaria, Statista (2018) lists 800 cats / 1000 citizens. There are no data on the number of cats bred in different cities, but it is common practice to breed 1-3 cats. Breeders prefer cats with pedigree, sparing no means of raising them. It is more difficult to raise cats in shelters and private homes, where the needs for food and comfort for the animals are much greater, but resources - limited. The use of local waste material will significantly reduce the cost of the finished product and will create the prerequisites for the greater distribution of biodegradable cat litter in their feline life - which means that the welfare of more animals can be increased at low costs.

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