Bund für Umwelt und Naturschutz Deutschland

BUND
FRIENDS OF THE EARTH GERMANY

BUND-Background

Environmental impact of microplastics from artificial turf pitches

More and more studies show that microplastics are widespread and accumulate in the environment. Especially in the aquatic environment, harmful effects on organisms and ecosystems are likely.[1] Among the many sources of microplastic are artificial turf sports fields. According to the German Football Association, there are about 5000 artificial turf sports fields [2] and about 1000 DFB mini-pitches in Germany.[3] Since these are mostly filled with plastic granulate, they represent a potential source of microplastics into the environment. According to recent studies, between 18,000 and 72,000 tonnes of plastic granulate are released into the environment every year from artificial turf pitches in Europe.[4] With an emission of about 8,000 tons/year, artificial turf pitches are thus the fifth largest source of primary microplastics in Germany.[5]

What is microplastic? - Definition

Microplastic is scientifically defined as solid, insoluble, particulate and non-biodegradable synthetic polymers smaller than 5 mm. Microplastic is divided into primary and secondary microplastic. Primary microplastics are defined as particles that already have a size of less than 5 mm when they enter the environment. Primary microplastic type A is produced in this small size. These include, for example, particles used in the cosmetics and personal care industry or plastic granulate on artificial turf pitches. Primary microplastic type B is produced during the use phase. This includes, for example, the abrasion of car tyres or synthetic textile fibres that get into the waste water during washing. Secondary microplastics are created during the decomposition of larger plastic parts in the weathering process by wave motion and solar radiation.

[1] Lassen et al (2015)
[2] https://www.welt.de/politik/article197156495/Breitensport-Geplantes-Kunstrasenverbot-der-EU-bedroht-Amateur-Fussball.html
[3] https://www.minispielfeld.de/de/minipitch
[4] Hann et al (2018)
[5] Fraunhofer-Institut UMSICHT (2018)

This means that the problem with artificial turf pitches are the granulates, not the pitches themselves, and therefore alternatives must be found for the plastic granulate. Physical measures to reduce the amount of artificial turf entering the environment can be implemented immediately, even without large financial resources.

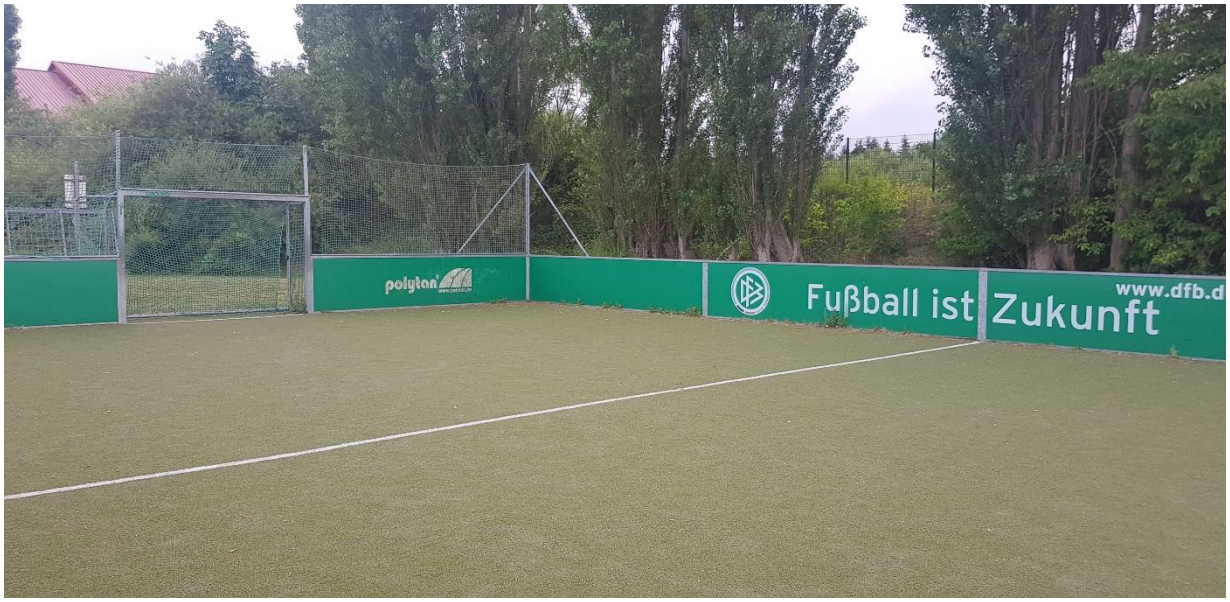

Fig. 1: DFB-mini-pitch with artificial turf

Construction of an artificial turf pitch

The most commonly used type of artificial turf is the 3rd generation turf design [6] The 3-6cm long straws [7] consist of polyethylene with a primary and a secondary backing.[8] The artificial culms are woven into a carpet7 and between the fibres there is a stabilizing filling of sand.[9] The sand serves to keep up the polyethylene fibres during use and to achieve the desired properties.[10] On top is the performance filling, which mostly consists of plastic granulate,[9] which is mainly responsible for the entry of microplastic through artificial turf pitches.[9] It serves to reduce the risk of injury due to shock absorption and to create a similar playing feeling as on natural grass.[11] Sometimes there is a shock pad under the culms with the granulate, which absorbs the forces during play and can thus reduce the need for plastic granules.[12] Nevertheless, 61% of the pitches do not use

[6] Hann et al (2018), Lassen et al (2015)
[7] Magnusson et al (2016)
[8] Eunomia Research & Consulting Ltd (2017)
[9] Hann et al (2018)
[10] Eunomia Research & Consulting Ltd (2017), Lassen et al (2015)
[11] Eunomia Research & Consulting Ltd (2017), Hann et al (2018), Fath (2019)
[12] Eunomia Research & Consulting Ltd (2017), Magnusson et al (2016)

a shock pad, as it is cheaper to achieve their functions with additional cheap filling material such as styrene-butadiene rubber (SBR).[13]

Material of the granulate

The plastic granulate used for the performance (playing behaviour and feel) can consist of different materials depending on the desired properties.[14] The majority of artificial turf pitches use styrene-butadiene rubber (SBR) obtained from the rubber of old tires due to its low cost.[15] This may contain Polycyclic Aromatic Hydrocarbons (PAH), which have an impact on the environment. In the aquatic environment fish and other aquatic organisms can absorb them. Many PAHs are carcinogenic and genotoxic and can cause embryonic malformations. They also accumulate in the environment due to their resistance.[16]

Abb. 1: Ausschnitt eines Kunstrasensportplatzes von oben

In some cases, newly manufactured polymer fillings[17] aus Resten der industriellen Kunststoffproduktion verwendet: Etylen-Propylen-Dien-Kautschuk (EPDM) und andere Thermoplastische-Elastomere (TPE made from residues from industrial rubber production are also used: Ethylene-propylene-diene monomer (EPDM) and other thermoplastic elastomers (TPE).[18] TPE in particular, but also EPDM, cause significantly higher quantities of carbon dioxide than SBR, because they do not have to be recycled, but have to be produced again and again.

So far, only few organic alternatives have been used: cork and fibres from coconut shells, which have a significantly lower environmental impact.[13] Pitches filled exclusively with sand could be a suitable alternative, as they have already been used successfully in Hamburg for ten years as an alternative to plastic granulate.[19] Since unfilled artificial turf pitches do not provide the desired performance for football, they are only used for sports with other requirements (e.g. hockey).[20]

Entry pathways

[13] Eunomia Research & Consulting Ltd (2017), Lassen et al (2015)
[14] Magnusson et al (2016)
[15] Eunomia Research & Consulting Ltd (2017), Fath (2019), Hann et al (2018), Lassen et al (2015), Magnusson et al (2016)
[16] Fath (2019)
[17] Eunomia Research & Consulting Ltd (2017), Lassen et al (2015), Magnusson et al (2016)
[18] Lassen, C. et al (2015)
[19] https://www.hamburger-sportbund.de/artikel/5018/kunstrasenplaetze-und-mikroplastik-situation-hamburg
[20] Eunomia Research & Consulting Ltd (2017)

Since the plastic granulate is not firmly bonded to the artificial turf and is exposed to all weather conditions, it can easily get outside the pitches. The granulate catches on the clothes and shoes of the athletes and is thus carried into streets, sewers and households[21], where it ends up in the wastewater from washing machines.[22] In extreme weather conditions, the granulate is distributed in the environment by wind and rain and lands in the surrounding waters.[21] From adjacent soils and asphalted areas it finally reaches marginal waters or the sewage system.[23] In addition, large quantities of granulate are removed from the pitch during snow removal in winter and spread outside the pitch during thaw.[22] In addition to the granulate, secondary microplastic is released on the same pathways by abrasion of the blades of grass.[23]

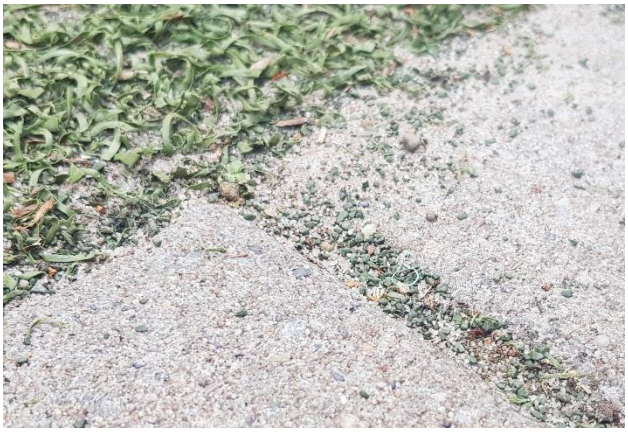

Fig 3: Losses of granulate on the surrounding running

Emission amount

The amount of granulate filling required for an artificial turf surface depends on the size of the surface, the type of use, the construction of the pitch and the material used.[24] Non-contact sports such as tennis are usually played on 2G turf, which contains only a stabilizing sand filling. For football pitches, on the other hand, SBR is applied with an average density of 16 kg/m². The standard area of the pitches is 7,526m². According to this, the total filling quantity of a football pitch is about 120 tons.[25] Every year 3-5 tons of granulate are refilled per football field.[26] However, the refill quantity is not only influenced by granulate losses, but also by the compaction of the granulate in the field.[27] It can therefore be assumed that approximately half of the required refill quantity is due to granulate losses, so that 1.5-2.5 tonnes per pitch are discharged into the environment every year.[28] Other estimates are similar, with a loss between 1.5 and 5 tonnes/year under the assumption that 1-4% of the total quantity is lost annually.[29] For the 51,616 pitches in Europe with a total area of 112,000,000m², a infilling of 16.1 kg/m² results in losses of between 18,000 and 71,105 tonnes/year.[30] In Germany,

[21] Fath (2019)
[22] Eunomia Research & Consulting Ltd (2017), Magnusson et al (2016)
[23] Lassen et al (2015)
[24] Magnusson et al (2016)
[25] Hann et al (2018)
[26] Lassen et al (2015), Magnusson et al (2016)
[27] Hann et al (2018), Lassen et al (2015)
[28] Kole et al (2017), Lassen et al (2015)
[29] Hann et al (2018), Eunomia Research & Consulting Ltd (2017)
[30] Hann et al (2018)

5,000 football pitches with 120 tons of filling material per pitch thus cause losses of 6,000 to 24,000 tons. The Fraunhofer prudence study calculates losses of 8,000 tons per year.

Removal and disposal

In addition to this microplastic emission during the use of an artificial turf pitch, the removal and disposal are further problems. The estimated lifespan of an artificial turf pitch depends on the frequency of use and maintenance and amounts to averages ten years.[31] One option for stay for an artificial turf pitch after the end of its life cycle is to reuse it. The turf or components are removed and recycled in a new installation with the same or similar function. The problem is that the granulate is mixed with sand. This results in higher effort and higher costs. With the second option, recycling, the contaminations cause that only downcycling can take place. However, turf manufacturers have so far not supported this disposal method very much, so that many recycling plants have been closed again. This means that support for turf producers is required in order to achieve closed recycling cycles and to establish recycling as a suitable option. Especially in Europe this is viable due to the proximity to recycling companies. Due to the lack of establishment of these two options, many artificial turf sports fields end up in landfills and incineration plants.

The cost of disposing of a pitch is €9,000-45,000. [32]

Receivables of the BUND

Artificial turf pitches are the fifth largest source of microplastic input. Since the loss of granulate cannot be completely prevented, plastic granulate must be banned from artificial turf pitches. In addition, even in the interim phase, clubs are obliged to prevent the entry of granulate into the environment at existing pitches. New disposal methods must also be found and established.
Therefore the BUND claims:

1. Prohibition of plastic granulate

Due to the large losses of microplastic due to artificial turf pitches, the ban on the use of plastic granulate is unavoidable. Alternatives must be found which do not endanger the safety of the athletes and the performance of the pitch. Promising options could be sand-filled pitches or alternative filling materials such as cork or coconut shells.

2. Further development of alternative materials

[31] Eunomia Research & Consulting Ltd (2017), Lassen et al (2015), Magnusson et al (2016)
[32] Eunomia Research & Consulting Ltd (2017)

The practical suitability of these organic alternatives to plastic granulate must be tested as quickly as possible. Even with the more environmentally friendly alternatives, the use of materials should be kept as low as possible. For new constructions, shock pads should therefore be installed under the turf, as they reduce the need for filling material by 50%[33] and can be reused when the artificial turf is renewed.[32] Turf with a high culm density or structured grass blades also minimizes the need for filler and the amount of granulate that flies out of the field when playing.[34]

3. Further development of disposal systems

The possibilities of illegal disposal must be eliminated and recycling must be supported. This requires closed cycles and support from turf manufacturers. Contracts for the installation of a pitch should be extended to disposal, so that the installer is responsible for the pitch at the end of its life.[35]

4. Immediate measures for existing pitches

- In order to minimize the microplastic input from existing pitches in the interim phase, various physical barriers should be set up.
- In order to support the sportsmen* women in leaving the granulate on the pitch, areas should be installed where they can remove the filling material before leaving the pitch.[36] Possibilities are brush-off zones or stamp off areas at the exit of the pitch.
- A hard surface around the pitch can make it easier for maintenance personnel to collect scattered filler material and bring it back onto the pitch. In addition, an edge reduces the spread of the microplastic, especially in elevated areas. Außerdem können die Füllmaterialverluste durch Filter in den Abflüssen reduziert werden.
- During storage and refilling of filling material, it must be prevented from getting into the environment.
- Escaped granules must be swept up and returned to the playing field.
- Waste that could contain microplastics must be disposed of carefully. Leaf blowers should be avoided in order to prevent granulate loss.
- Snow removal should be avoided and snow should never be placed on areas with grass or soil outside the field.
- Filters in the shower drain and collecting the granules in a collection container in the

[33] Magnusson et al (2016)
[34] KIMO, Fidra (2018a)
[35] Eunomia Research & Consulting Ltd (2017)
[36] KIMO, Fidra (2018a)

changing rooms can help users minimize microplastic emissions.[37]

5. Awareness-raising measures

Finally, the users of the playing field must also be informed about their individual possibilities for reducing the loss of granulate. This can be done, for example, by means of posters. Before leaving the pitch, users should remove granulate from their shoes and clothing. If available, the brushes and stamping areas mentioned above should be used for this purpose. In the changing room and before washing, sportswear should be shaken out over the garbage can. Granules should never be washed or thrown away outside, but should be collected and returned to the playing field or disposed of properly.[38]

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