FACT SHEET ON THE APPLICATION OF RUBBER GRANULATE FOR ARTIFICIAL TURF PITCHES IN DENMARK

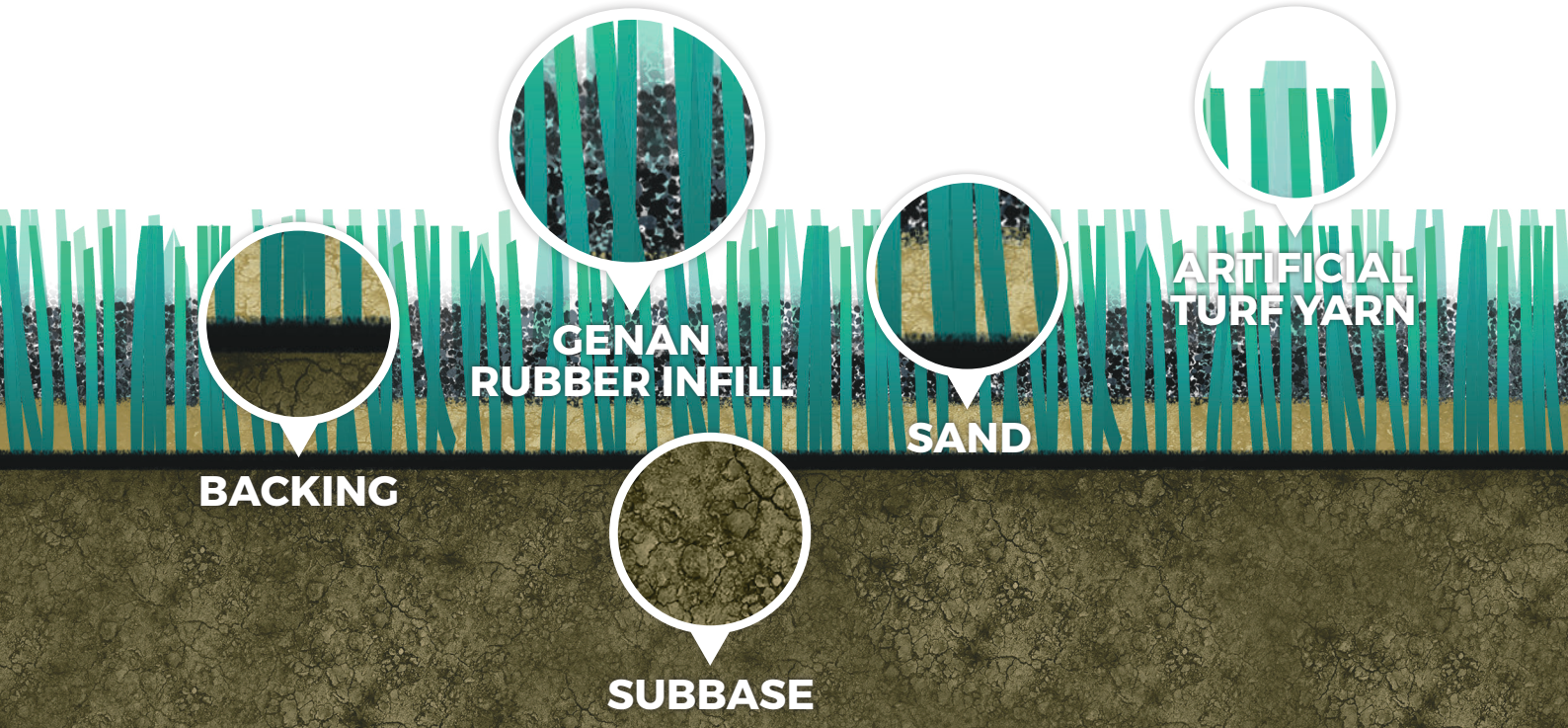
THE PREVALENCE OF ARTIFICIAL TURF PITCHES IN DENMARK

- The use of artificial turf pitches for football and other sports is gaining ground. You can play on them all year round, and they withstand more frequent and intensive use than conventional grass pitches.
- The fact that artificial turf pitches in this way increase the number of hours of activity year-round has a positive effect on public health.
- There are 348 artificial turf pitches registered in Denmark. In 2007, the register counted 45 artificial turf pitches.
- The first full-size, artificial turf pitch (for 11-man football) still in use was installed in Ikast in 1992.
- There are 16,613 inhabitants per artificial pitch nationwide.
- By region, and as registered at the beginning of 2019, the number of artificial turf pitches looks as follows:
  - 31 pitches in Region Nordjylland (Northern Jutland)
  - 77 pitches in Region Midtjylland (Central Jutland)
  - 70 pitches in Region Syddanmark (Southern Jutland)
  - 54 pitches in Region Sjælland (Zealand)
  - 116 pitches in Region Hovedstaden (Copenhagen)
- Artificial turf pitches are fully accepted by the major football associations, FIFA and UEFA – and are now also approved for matches at all levels, incl. Champions League and the World Cup.

ARTIFICIAL TURF PITCHES AND RUBBER GRANULATE

- In a typical artificial turf pitch, the application of rubber granulate (also known as infill) is an all important factor for playing properties to resemble those of natural grass as much as possible. Rubber infill is spread across the stabilising sand layer, and granules lie between and support the grass blades, providing the right resistance and shock-absorption for the ball to roll and bounce naturally. Infill granulate also protects players from getting skin burns or more serious injuries.
- The most commonly used rubber granulate for infill material is made from end-of-life tyres (ELT). The tyre industry has spent decades developing a durable and elastic material with high friction, and end-of-life tyres thus possess some fantastic properties, which are put to good use in infill material.
- Rubber granules are typically between 0.8 and 3 mm in size – and are thus by definition categorised as microplastics.

- The quality of infill is pivotal for pitch properties. The right particle size distribution ensures that the infill material falls in perfect place around the blades, offering shock-absorption for the safety and comfort of players – and providing the right ball and stud resistance at the same time.
- Rubber granules get caught in the shoes and clothing of players and are in that way carried off the pitch. Rubber granulate may also be removed from pitches during pitch maintenance or snow removal.
- As infill material consists of different particle sizes, rubber granules will gradually compact as the artificial pitch is being used. In order to minimise this compaction, pitch maintenance must be carried out regularly – in the form of raking and brushing. Minimal, continuous compaction is inevitable, though, requiring occasional re-fill of infill to ensure an even layer of granulate.
- Different prevention measures should be set up to ensure that granules stay on the pitch, so the pitch may be regarded as a closed installation. There should be a barrier / infill fencing panel around the pitch – as well as a clean-down exit area, where clothes must be brushed off and shoes emptied.
- Apart from occasional re-fill of rubber granulate, an artificial turf pitch must also be maintained – just like a conventional grass pitch must be maintained.
- Maintenance costs are much lower for artificial turf pitches than for conventional grass pitches, and you need not rely on natural resources such as water nor on fertiliser or pesticides.



Construction of an artificial turf pitch

ENVIRONMENTAL CONSEQUENCES OF USING RUBBER GRANULATE IN ARTIFICIAL TURF PITCHES

- In average, 2,200 kg of granulate a year is added to each pitch (re-fill). This quantity varies a lot from pitch to pitch – depending on daily routines and maintenance efforts. In recent years, increased focus on optimising routines related to both use and maintenance has led to a reduction of re-fill volumes.
- Most of this annual re-fill does not replace material which has disappeared from the pitch. Compaction accounts for approx. 66-87% of the need for re-fill. This may sound like a whole lot, but 10 years of such compaction will only increase the thickness of this layer by 3-5 mm. Compaction is thus nearly invisible to the naked eye.
- The loss of material removed in the shoes and clothing of players totals approx. 40 kg per pitch per annum in average. Such material lost will end up in waste water treatment plants, e.g. through washing machine drains. Alternatively, it will be swept up from e.g. changing room floors and collected as refuse for waste incineration. This will result in an annual discharge of rubber granulate to the aquatic environment of approx. 0.8 kg per pitch – i.e. if players do NOT brush off their clothes and empty their shoes before they leave the pitch.
- Rubber granulate discharged with water from the pitch will end up in waste water treatment plants, stormwater ponds or as direct discharge. According to a comprehensive literature study made by the Danish Technological Institute in May 2019, this will result in an annual discharge to the aquatic environment of approx. 2.5-36 kg per pitch. A recent Swedish study from October 2019, prepared by Ecoloop on behalf of the Municipality of Kalmar, has registered and monitored the specific channels through which granules might spread from a newly installed artificial turf pitch with an impermeable bottom. Findings are that discharge of microplastics to the aquatic environment amounts to 100 grammes a year, of which approx. 10%, i.e. 10 grammes, is rubber granulate.
- In Denmark, a study shows that many initiatives have been taken in order to avoid the migration of rubber granulate to the environment – in the form of fencing, percolation and closed wells. As far as Denmark is concerned, the expected discharge to the aquatic environment should thus be at the low end of the 2.5-36 kg per pitch per annum interval.
- In comparison, theoretical calculations show that wear from shoe soles accounts for an annual discharge to the aquatic environment of between 10 to 260 tonnes of microplastics.
- Other sources of migration of microplastics to the aquatic environment are road and tyre wear, paint particles, the washing of synthetic clothing/fabrics as well as personal care products.

HOW THE RECYCLING OF END-OF-LIFE TYRES INTO RUBBER GRANULATE AFFECTS THE CLIMATE

- As long as humans drive vehicles with tyres – and the total amount of driving increases every year – there will be a worldwide need to dispose or recycle large amounts of rubber from car tyres (so-called End-of-Life Tyres – ELT in abbreviation).
- Each year, approx. 20 million tonnes of car tyres are scrapped worldwide. This corresponds to approx. 5 million tyres a day, and this number currently increases by approx. 4% a year. There are several ways to dispose of these large amounts of tyres. – Tyres can be incinerated in e.g. cement kilns, they can be buried (landfilling) or they can be recycled. Tyre recycling is the most climate-friendly disposal method, and with the Genan technology, 90% of a tyre is recycled.
- For each tonne of tyres recycled through Genan technology instead of being incinerated, the climate will be spared a minimum of 0.7 tonnes of CO_2 emissions.
- In the EU, more than 1 million tonnes of car tyres are incinerated each year. This is a waste of good resources and raw material, and the environment would be spared 700,000 tonnes of CO_2 emission as a minimum, if tyres were instead recycled.
- Rubber granules in artificial turf are an important element in the circular economy of the sustainable application of end-of-life tyres. If the recovery of rubber granulate through the use in artificial turf pitches should stop, tyres will instead be incinerated, and the climate will be negatively impacted by considerably increased volumes of CO_2.

THIS FACT SHEET HAS BEEN PREPARED ON THE BASIS OF INFORMATION FROM I.A.:

- *Facilitetsdatabasen.dk (information about the number of artificial turf pitches in Denmark)*
- *Idrættens Analyseinstitut, "Boom i kunstgræsbaner har ændret idrætslandskabet", 2018 ("Artificial turf boom has changed the sports landscape", 2018)*
- *Miljøstyrelsen, "Vejledning om kunstgræsbaner", 2018, samt rapport nr. 1793, 2015 (the Danish Environmental Protection Agency, "Guide on Artificial Turf Pitches", 2018, as well as report no. 1793, 2015)*
- *The "Life Cycle Assessment" report, 2018, prepared for Genan by a number of European experts from i.a. IFEU (Germany) and FORCE (Denmark)*
- *European Chemicals Agency (ECHA), "Annex XV report: An evaluation of the possible health risks of recycled rubber granules used as infill in synthetic turf sports fields", February 2017*
- *The report "Massebalancer af gummigranulat, som forsvinder fra kunstgræsbaner – med fokus på udledning til vandmiljøet", December 2018, revised May 2019. ("Mass balances of rubber granulate disappearing from artificial turf pitches with focus on discharge to the water environment", November 2018). A literature study of all recent, available Danish and international, scientific sources on this topic, prepared at the request of Genan by Hanne Løkkegaard, Bjørn Malmgren-Hansen and Nils H. Nilsson, Afdeling for Bio- og Miljøteknologi på Teknologisk Institut (the Department for Biotechnology and Environmental Technology at Teknologisk Institut (the Danish Technological Institute))*
- *The report "Forskningskampanjen 2017 - Sjekk kunstgressbanen" (The 2017 Research Campaign - Check the artificial turf pitch"), prepared by the Norwegian research council Forskningsrådet, Nettverk for miljølære (Miljolare.no) and researchers at NILU, Akvaplan-niva, SINTEF and Havforskningsinstituttet (the Institute of Marine Research) respectively.*
- *The report "Dispersal of microplastic from a modern artificial turf pitch with preventive measures - Case study Bergaviks IP, Kalmar", October 2019, prepared by Fredrick Regnell, Ecoloop, at the request of the Municipality of Kalmar, Svensk Däckåtervinning and Ragn-Sells.*