WINTER MAINTENANCE OF SYNTHETIC TURF WITH THE HELP OF CRYOTECH CMA AND NAAC PRODUCTS

Abridgement of Thesis of Heikki Haaraoja for the Finnish Sports Institute Vierumäki, April 2013 (about 5 pages)

With the approval of Mr. Heikki Haaraoja MK Trading A.S / Tapio Raukola has added information in the Abridgement as single sentences here and there, and made its headlines. The added information is not included in Haaraoja's original text. Thesis of Heikki Haaraoja is available uncut with pictures at www.mktrading.no/käyttösovelluksia/tekonurmikentät - Oppilastyö 2013.

Abstract

Based on experiences in Norway, tests were initiated in Finland to experiment use of acetate chemicals to help in winter maintenance of synthetic turfs during the winter 2012 to 2013.

The tests were carried out on three sports grounds with synthetic turf (Vantaa City - Tikkurila Sports Park, Myyrmäki ISS Stadium – Vantaa and Raasepori Town – Karjaa Sports Ground). MK Trading A.S Norway, Oslo, is marketing the tested Cryotech products CMA and NAAC in the Nordic Countries through its representative in Finland.

The Vantaa City ground was kept open for the users through the winter. The meaning was not to switch the heating on at all after it was switched off just at the beginning. Many shortcomings were observed in maintenance actions. For instance crushed rubber was supposed to be added in the autumn, but was not added at all. As a consequence fibres of the turf were lying horizontally in many places and that prevented chemical pellets from getting to the bottom of the turf. Also, in the middle of the winter there was a three week period when the chemicals were not used at all. The bottom of the turf froze. A couple of times during the winter heating had to be switched on to have the bottom melted. Though, about 17 000 € savings were recorded in energy costs compared to that of the previous winter. Feedback from the users was positive. The tested chemicals were Cryotech CMA and NAAC. The trial will continue.

The ISS Stadium in Vantaa Myyrmäki joined the testing project soon after Tikkurila. They had a different approach from that in Tikkurila. Both heating and chemicals were used simultaneously. Much attention was paid to the procedure of brushing and raking into different directions to help maintaining upright position of fibres. Snow was removed up to the tops of turf and the remaining snow was melted with CMA. Cost savings were not calculated.

On the Raasepori ground in Karjaa the accumulated snow was removed on the 18th of February 2013. The following day Cryotech NAAC was spread on the remaining 5 cm of snow (it should have been less). The snow turned into wet light colour slush due to the influence of NAAC. The rest of snow was gradually melted by frequent brushing and minor application of CMA at places. The field was taken into use on the 25th of February, in the evening. Savings were about 20 000 € in the energy costs. Some parents were worried about the use of chemicals for maintenance, and Raasepori town gave additional information on them. EU and Tukes, Finland do not classify these chemicals as dangerous chemicals.

Lappeenranta town tested in March 2013 Cryotech NAAC for removing ice from the Sammonlahti field in order to start its summer period activities. It was observed that NAAC pellets penetrated into ice, but the ice was not removed as long as it was brittle and the ice cover was re-frozen. The ice was then removed with conventional methods over a longer period of time.

1 Introduction

Cryotech Ltd manufactured acetate-based chemicals have been tested and used in Norway for more than 7 years for assisting in winter maintenance of synthetic turfs. It has been easier to remove snow when the snow/ice bond and ice formation have been prevented. Also, with the help of chemicals it has been possible to melt hoar frost, and snow and ice residues after ploughing. Safety of players has been maintained and there have been remarkable savings in energy costs of grounds. The method itself and the related equipment, especially ploughs and brushes/rakes have been developed suitable for artificial turfs during the 7 years.

What about Finland? It has been faced that winter maintenance of grounds has not always succeeded as expected. Thus, fibre has worn out soon or been disconnected, and expenses have become high. The entire turf may have had to be replaced in a relatively short period of time. Safety may not have been on a required level because heating has not been able to keep the tops of turf melt. Ice fern at places has been slippery and unsafe for the players. Heating costs have been even staggeringly high.

Inspired by the experiences in Norway the testing started in Finland in the winter 2012 – 2013 altogether on four fields. Based on observations it was seeked to deduce how well the use of chemicals fits to the winter maintenance of Finnish sports grounds. The Finnish Sports Institute Vierumäki became a partner for the programme and as a consequence it had this Thesis done.

Cryotech CMA (Calcium Magnesium Acetate) and NAAC (Sodium Acetate) were used as the testing products. They are marketed in the Nordic Countries by MK Trading A.S (www.mktrading.no). It has a representative in Finland.

2 Tested products and their effects

2.1 Cryotech CMA

The main acetate chemical for winter maintenance of synthetic turfs is Cryotech CMA. The granules are round yellowish pellets. The product was originally developed as an alternative de-icing chemical for highways and airfields. On highways it has been used since 1986 to replace normal road salts such as sodium chloride on environmentally sensitive areas, and to prevent concrete corrosion. It is affective down to -7°C (surface temperature). Effectiveness increases in sunshine and in increasing temperatures. CMA does not melt surfaces wet as do chloride based chemicals. In wet conditions any de-icing chemical is diluted. Because Cryotech products have a dry and slow way to melt they are long lasting after snow/ice remova.l CMA is hygroscopic meaning that it attracts moisture from e.g. ambient air.

CMA is most commonly spread either just before a snowfall or forecast freezing. The spread amount is usually 100 g/m² or about 700 to 800 kg per a normal size field. If the temperature is getting very low, NAAC should be selected instead of CMA.

2.2 Cryotech NAAC

NAAC granules have a round pellet shape as that of CMA, but the colour is bright white. NAAC is exothermic meaning that it releases heat when dissolving. It starts working immediately after spreading. Its corrosion effect is very low and NAAC is effective down to -18°C.

NAAC is good for melting snow and ice that has already accumulated on the field. Though, it must be remembered that excessive snow must always be removed before spreading. Melting means that the pellets drill themselves through snow and ice and then the brittle ice thickness can be easily removed. NAAC is the right choice, if the ground has been closed the entire passed winter, or it has deep-frozen. Spreading amount recommendation is 100 g/m².

3 Tests

3.1 Tikkurila Synthetic Turf, Vantaa City

Beginning

Vantaa City, Tikkurila Sports Park, joined the testing programme on the 10th of December 2012 at the time the programme was started. A day before the inception seminar heating of the field was switched off and CMA was spread on one half of the ground. The other half remained untreated. The CMA half was then brushed in order to get the pellets to the bottom of the turf.

The next day it was snowing from the morning. In the afternoon both halves were covered by 2 cm of snow. Snow could be hand-wiped off easily from the CMA-half and not only from the surface but also from the fibre. On the untreated half fibres remained full of snow after hand-wiping, and the snow could be removed only from the surface.

The temperature was -5°C. Extensive snow removal was not carried out because the available snow plough had a brush installed instead of a blade. The Mk Trading representatives from Norway told about ploughs developed in Norway that have a rubber or plastic blade, thickness about 10 mm. The same set of blades has been used for two to three winters and only on sports grounds. Using the same set of blades for many places could cause uneven wear of blades.

Reasons for Joining the Testing

City of Vantaa wanted to join the testing programme because of high heating costs of the field, inspired by the encouraging experiences received in Norway. The city has committed itself to stay along with the programme for three years to ensure sufficient, reliable experiences.

The turf has been re-built in 2007 when a Saltex third generation synthetic turf was installed. In that sand used in turf was replaced by crushed rubber.

The earlier practice was that heating was used with the capacity of 10 to 30 % out of the maximum. For certain important matches the capacity was raised close to the top efficiency. In the winter 2011 – 2012 heating costs were nearly € 40 000.

Experiences

For the actual testing the City acquired a new set of blade for the snow plough. After brief tests a 10 mm thick rubber blade type was selected.

The chemical spreading device was Dakota Turf Tender with a dual spinner.

For some reasons the turf was not treated with CMA or NAAC for three weeks resulting in freezing. Though, the temperature was at times as high as -20°C.

The representative of MK Trading for Finland and the writer of this thesis visited the site on the 7th of February 2013. The turf was then covered by a 2 cm snow layer after a snow fall and the turf was frozen and hard. It was decided that snow is ploughed off and 750 kg of NAAC spread on the field. The measures were made immediately after which brushing of pellets was carried out. High snow banks around the turf indicated that snow had been frequently removed.

During the following three days about 10 cm fresh snow was falling down and ploughing was done several times. Bottom of the turf did not melt with NAAC, but with heating that was kept on for three days.

Why NAAC did not melt the turf bottom? One significant reason might have been that the ground rubber was not added at all in the previous autumn. Because the fibres were not sufficiently supported by rubbers they layed horizontally and prevented the NAAC pellets from getting through to the bottom inspite of brushing. Other reasons might have been that the direction of ploughing is always kept the same and too little brushing was done.

Summary of Tikkurila Experiences

The aim was at maintaining the ground without switching the heating on at all, but just use Cryotech pellets. The heating had to be used altogether for 12 days. Many things were done in the wrong way, but many things were learned also.

The cost of the used CMA and NAAC pellets was about € 8000. The heating costs were € 13 800 altogether between December 2012 and February 2013. Thus the total costs amounted to € 21 800. During the previous winter the heating costs had been € 38 900. Compared to that the savings in heating costs were about € 17 000. It must be noted that the winter 2011 – 2012 started only just before the middle of January whilst the following winter started right at the beginning of December.

Manager for youth activities at Tikkurila football club told that all trainings could be implemented well without exception. A few times the users had given feedback for hardness of the turf and smell. The spread chemicals CMA and NAAC are salts of acetic acid and therefore smell of vinegar can be identified. The field personnel had advised wash and rinse well used clothes and equipment after training.

For the following winters it is important to ensure that ground rubber is added early enough before the winter. All measures should be written down in detail in order to ease interpretation of observations. Weather forecasts are to be followed carefully to be able to make timely measures and anticipate actions. Success also requires that the whole maintenance team must be well-aware of the method and carry out the best practices as advised.

Snow was removed effectively in Tikkurila after the new plough blade concept was taken into use. The spreading device was excellent. Brushing/raking devices/procedures must be further developed in order to get CMA/NAAC pellets move vertically and to the entire thickness of the turf. Brushing in general should happen several times into different directions to ensure good results.

3.2 Myyrmäki ISS Stadium in Vantaa

Reasons for Joining the Testing

ISS Stadium in vantaa joined the testing programme shortly after the Inception Seminar in Tikkurila. Positive initial experiences from the Vantaa City ground in Tikkurila were as an incentive too.

The synthetic turf of ISS Stadium was installed in 2007. Earlier it was UEFA certified, but starting from the latest season the ground did not meet the UEFA requirements because of wear of the turf.

Experiences

The heating was switched on early in January 2013. December was very cold and the ground was frozen. It was snowing quite much in January and testing of CMA was started to help in snow removal. At first CMA was spread 600 kg one morning, but the area was not brushed afterwards. Pellets remained more on the top of the turf. Though, training took place in the evening, the same day. CMA pellets were to large extent transported indoors along with shoes and the next morning the floors were blackish and sticky. Vinegar smell could be sensed. It was snowing again in the morning and the ground was ploughed.

The second spreading of CMA was then done before the snowfall based on forecasts. This time pellets were brushed and they penetrated well into the turf. No pellets were observed indoors.

It was observed both times that snow is easy to remove when CMA is used. Also CMA kept snow dry and thus easy to remove. The turf stayed soft and on top of fibres there were no ice brittles. Small heating was kept on all the time.

Equipment

Equipment meant for the winter maintenance were doing well, according to Mr. Pasi Vänttinen, field manager. It was considered that there was enough ground rubber in the turf and its fibres were staying sufficiently upright. The turf was brushed weekly and each time into a different direction. Thus fibres could not fall into the horizontal position parallel to snow ploughing.

A Unisport plough was used for snow removal. Its ploughing height is adjusted by wheels so that the upright edge (as a bladeless blade) is sweeping tops of the fibre. The remaining snow was melted with CMA and heating combination. The plough is not the best for removing large amounts of snow.

Ice was removed with a tow-behind rake.

Summary and Future Plans

Heating costs at Myyrmäki ISS Stadium between January to March 2013 were about € 40 000. Heating costs were very high when switching the heating on at the beginning of January because of cold December (cool capacity of the ground).

The chemicals functioned well according to Pasi Vänttinen. It is worth continuing the testing the next winter. It was too early to estimate whether heating can be switched off and do the maintenance just wit CMA. In Pasi's vision both heating and CMA will be used because he thinks that might extend the lifetime of the turf.

Feedback from the users was very positive despite the problematic winter.

In the summer 2013 the old turf will be replaced by a new one. Also the depressed and frost susceptible subgrade will be repaired. The new turf will be delivered by the German Polytan. The ground rubber will be chanced also. The traditional black rubber will be green, which is supposed to withstand ploughing better than the black one. Again, the UEFA certification will be applied as soon as the repair has been done to facilitate international matches played on the ground.

3.3 Raasepori, Karjaa

Reasons for Joining the Testing

Raasepori Town joined the testing programme in order to save in heating energy costs. The turf of Karjaa Ground was built in 2008. It has been normally closed over the heart of winter and opened at the turn of February to March with a help of ploughing, heating and ground black rubber on the remaining snow. Heating costs were € 35 000 in the winter ending in 2011 and € 27 000 in the following winter. In 2013 heating was not used at all.

Test Experiences

The test began by snow removal (about 35 cm) on the 18th of February 2013. It was first done with a heavy weight farming tractor and then with a small tractor carrying the Unisport plough. The remaining snow depth was 5 cm as had been the case earlier with the old method. Thinking of use of the chemicals the depth was too much and the snow should have to been removed as closely as possible. Then 700 kg of Cryotech NAAC was spread on the 5 cm snow layer (106 g/m²) on the 19th of February. A rear-mounted fertilizer spreader with a spinner disk was used for this activity. The air temperature was -7°C and that of the field surface -8°C. During the following night the air temperature reached -15°C.

On the 20th of February the football ground was half-covered by relatively wet, but light colour slush. Though, the surface was not frozen. Obviously the 35 cm snow cover through the winter had been a good enough insulation against frost. It was decided to wait and see. On the 21st of February the ground was raked one time with the Unisport rake both longitudinally and transversally. Cryotech CMA was spread altogether 300 kg for places where ice fern occurred on fibre tops. Slush covered less than a half of the ground surface. NAAC pellets were not any more observed because they had totally melted.

The following days the day temperature rose close to 0 degrees and the sun was shining abundantly. The ground was deep-raked on the 25th of February and then the rest of slush, snow and ice were removed. No CMA pellets were left on the ground, and it was in a perfect condition in the evening when the field was opened for training. That was about a week beforehand compared to previous years.

CMA was still successfully spread on the 1st and 4th of March, 300 kg at the both times, in order to brush snow away and to prevent the ground from freezing. Due to these spreadings no moisture was observed on the ground after the snow brushing.

Summary

Responsible people of Raasepori Town were very satisfied with the test results. Mr. Yngve Romberg, sports secretaty, savings compared to the old method amounted to about € 12 000. In addition the ground was good enough for training already after 7 days from the first snow removal. If the snow had been removed more closely at the beginning, the ground would have been good even earlier.

Some parents of junior players were very worried about the used chemicals on the ground. They thought that it is not suitable for young people training because they were afraid that the chemicals have not been thoroughly tested for safety. They raised health problems to discussion, especially those concerning skin and eye impacts. Raasepori Town people delivered more exact information on Cryotech products and explained they have been tested from the beginning. They are not VOCs (volatile organic compounds) and they are water soluble. Possible eye impacts can be immediately eliminated with rinsing. According to EU and Tukes in Finland the used chemicals are not classified as dangerous chemicals.

3.4 Lappeenranta Town

Aim of the Experiment

In Lappeenranta Town there was a need to find a better method to remove ice from the fields that are ice-covered during winter for wintry sports activities. The test field was the Sammonlahti Field that has no heating under the turf. Earlier ice has been removed by milling the major amount of ice away. Then the remaining ice has been melted with a help of the sun and spread rubber particles. This has normally taken a couple of weeks.

Experiment

Ice on the field was first milled about 5 cm thick. On the remaining ice Cryotech NAAC was spread 100 g/m². NAAC pellets started immediately penetrate into ice forming holes. The holes did not reach the bottom of the ice. Impacts of NAAC were carefully observed even to the extent that the ice re-froze due to melt water created by the NAAC pellets. The testers ran out of NAAC and thus the ice was removed using the conventional methods.