Use of Shoddy in Stormwater and Soil Erosion Applications

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Many mattress constructions contain a material called a shoddy pad which sits between the spring unit and the foam layers. Shoddy is a nonwoven product made from virgin material and a wide range of recycled post-industrial textile scrap. In some cases, a nylon or polyester scrim mesh is incorporated to improve durability and dimensional stability. Due to the variable composition of this component and its lack of homogeneity, there are very few secondary uses for post-consumer shoddy. As a result, most shoddy recovered by mattress recyclers is currently landfilled.

MRC initiated a project with GHD and Humboldt University in Arcata, California in January 2020 to explore the potential use of recycled shoddy materials in civil engineering applications. We wanted to understand whether the fibrous nature of the material might be useful to filter stormwater or control soil erosion.

The project began with leachate studies to determine if shoddy used in an in-ground application could affect water quality. The testing found the shoddy contained small amounts of per and polyfluoroalkyl substances (PFAS) that apparently had been applied to apparel fabrics before the shoddy was manufactured.

The initial studies, however, were constructed to magnify leachate concentrations to a level much higher than would be observed in a real-world situation. For these reasons, MRC's contractors prepared a revised project plan to analyze whether shoddy used to filter storm water or control soil erosion would have a significant negative environmental impact and (if so) whether that impact could be mitigated. MRC decided to abandon this project at that time because the additional testing needed would be extensive and costly. Specifically, we note that:

1. Due to the variability of materials used to make shoddy, MRC would need to test a very large number of samples to statistically characterize the shoddy recovered from mattress recycling.
2. Even with good statistical characterization at the lab stage, and even if the lab tests showed that the shoddy posed no significant negative environmental impact or that that risk could be mitigated, significant additional testing at industrial scale would likely be required for each application.
3. The cost of preparing and conducting these leachate tests is very expensive, exceeding $2,000 per sample.

For these reasons, MRC concluded that pursuing this project at this time was not a good use of our time and resources.

List of all analytes

Analyte Acronym	Analyte Name	CAS Number
PFBA	Perfluorobutanoic acid	375-22-4
PFPeA	Perfluoropentanoic acid	2706-90-3
PFBS	Perfluorobutanesulfonic acid	375-73-5
4:2 FTS	4:2 Fluorotelomer sulfonic acid	757124-72-4
PFHxA	Perfluorohexanoic acid	307-24-4
PFPeS	Perfluoropentanesulfonic acid	2706-91-4
HFPO-DA	Hexafluoropropylene oxide dimer acid	13252-13-6
PFHpA	Perfluoroheptanoic acid	375-85-9
ADONA	4,8-Dioxa-3H-perfluorononanoic acid	919005-14-4
PFHxS	Perfluorohexanesulfonic acid	355-46-4
6:2 FTS	6:2 Fluorotelomer sulfonic acid	27619-97-2
PFOA	Perfluorooctanoic acid	335-67-1
PFHpS	Perfluoroheptanesulfonic acid	375-92-8
PFNA	Perfluorononanoic acid	375-95-1
PFOSA	Perfluorooctane sulfonamide	754-91-6
PFOS	Perfluorooctanesulfonic acid	1763-23-1
9Cl-PF3ONS	9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1
PFDA	Perfluorodecanoic acid	335-76-2
8:2 FTS	8:2 Fluorotelomer sulfonic acid	39108-34-4
MeFOSAA	Methyl perfluorooctane sulfonamidoacetic acid	2355-31-9
EtFOSAA	Ethyl perfluorooctane sulfonamidoacetic acid	2991-50-6
PFUnA	Perfluoroundecanoic acid	2058-94-8
PFDS	Perfluorodecanesulfonic acid	335-77-3
11Cl-PF3OUdS	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9
PFDoA	Perfluorododecanoic acid	307-55-1
MeFOSA	Methyl perfluorooctane sulfonamide	31506-32-8
PFTrDA	Perfluorotridecanoic acid	72629-94-8
PFTeDA	Perfluorotetradecanoic acid	376-06-7
EtFOSA	N-Ethyl perfluorooctane sulfonamide	4151-50-2
MeFOSE	N-Methyl perfluorooctane sulfonamidoethanol	24448-09-7
EtFOSE	N-Ethyl perfluorooctane sulfonamidoethanol	1691-99-2

Detected		Sample 1 - 1996		Sample 2 - 2011		Sample 3 - 2012		Sample 4 - 2013			
Analyte	**CAS Number**	**Conc. (ng/L)**	**Qualifiers**	**Conc. (ng/L)**	**Qualifiers**	**Conc. (ng/L)**	**Qualifiers**	**Conc. (ng/L)**	**Qualifiers**	**MDL**	**RL**
PFBA	375-22-4	9.99		ND		ND		ND		0.361	1.98
PFPeA	2706-90-3	17.6		ND		ND		ND		0.634	1.98
PFBS	375-73-5	ND		8.25		ND		18.1		0.887	1.98
4:2 FTS	757124-72-4	ND		ND		ND		ND		0.688	1.98
PFHxA	307-24-4	63.1		9.18		ND		8.11		1.08	1.98
HFPO-DA	13252-13-6	ND		ND		ND		3.38	Q	2.39	2.48
PFHpA	375-85-9	143		ND		11.3	Q	ND		0.293	1.98
6:2 FTS	27619-97-2	ND		2.17		1.83	J	2.22		0.991	1.98
PFOA	335-67-1	120		213		661		95.3		0.322	1.98
PFNA	375-95-1	49.6		3.42		2.79		2.34		0.401	1.98
PFOS	1763-23-1	16	B	7.91	B	2.77	B	4.02	B	0.4	1.98
9Cl-PF3ONS	756426-58-1	ND		0.95	J,Q	ND		1.22	J,Q	0.718	1.98
PFDA	335-76-2	13.8		5.77		2.16		4.28	Q	0.738	1.98
8:2 FTS	39108-34-4	6.88		1.22	J,Q	2.28		1.69	J,Q	1.02	1.98
MeFOSAA	2355-31-9	29.7		ND		ND		ND		0.817	1.98
EtFOSAA	2991-50-6	25.4		ND		ND		ND		0.679	1.98
PFUnA	2058-94-8	4.69	Q	ND		ND		ND		0.52	1.98
MeFOSE	24448-09-7	25.4		ND		ND		ND		3.01	9.91

Data Qualifiers

B: This compound was also detected in the method blank (0.538 ng/L)J: The amount detected is below the Reporting Limit/LOQ
Q: The ion transition ratio is outside of the acceptance criteria

Sample	Date of construction	Weight (gm)	Material density (g/cm^3)
1	10/4/1996	338.48	0.103
2	9/5/2011	332.55	0.110
3	11/29/2012	334.27	0.098
4	8/14/2013	334.62	0.114

Soaked 19 days in distilled water