Enabling local communities to utilize waste fishing gear in construction materials

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Presentation outline

- Motivation
- Who are we?
- Why using fibre reinforcement in construction materials?
- Nylon 6 fibres from discarded nets for structural concrete
- PE fibres from discarded nets to prevent early age cracking
- What next?
Motivation

- Reuse of a waste material which is piling up in the Greenlandic dumps
- All construction materials transported to Greenland at high costs
- Do the waste fish nets have properties enabling use in the construction industry?
Arctic Technology Centre

- Arctic Technology Centre (ARTEK) was formally established in 2000
- The centre is located in Sisimiut (Greenland) and (Lyngby) Denmark
- BEng in Arctic Engineering and Master in cold climate engineering
- Research within: Arctic buildings and construction, environmental technology, and infrastructure
ZeroWaste Byg

- Redesigning construction materials towards a zero waste society
Why using fibre reinforcement?
Why using fibre reinforcement?

- The addition of fibres is an effective way to improve the performance of concrete
- For **structural** purposes – improvement of mechanical properties, e.g. ductility
- For **durability** purposes - control of plastic **shrinkage** cracking
Fishing nets for experiments

PE
From mixed nets

Nylon 6
Cut from one net

Ålesund, 18th – 19th of April 2018
Nylon 6. Cut in 2 cm long fibres
Structural purpose - flexural strength
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PE fibres from fishing nets

- Recycled PE fibres from waste fishing nets processed at Plastix A/S, Denmark
- Mechanical cutting operation → different fibre lengths
PE fibres from fishing nets

- Impurities (mix of sand, micro plastic etc.) washed out of the fibres

- Fibres ready to being mixed into construction materials
Structural purpose - flexural strength. PE fibers
Fibre in cement matrix

- Analysis of crack-surface of fibre reinforced mortar
- Long-term deterioration of fibres in cement
Plastic shrinkage cracking

- Testing mortar specimens with and without fibres under controlled environmental conditions in laboratory (temp., humidity, wind)

- Method: Casting on top of rough concrete block to “restrain” the fresh mortar overlay
  The overlay cracks when no fibres are added, so we can examine the effect of fibres
Plastic shrinkage cracking

- Taking pictures of the surface to evaluate the crack development
- Plastic shrinkage cracking occurs in the first few hours after casting

1 h after casting

25 hours after casting
Plastic shrinkage cracking

Major strain (%) = Relative displacement

Reference (no fibres)  2 % of PE fibres

1 % of PE fibres  3 % of PE fibres
Recapitulation/take home message

**PE from mixed nets**

For **durability** purposes - control of plastic **shrinkage** cracking

**Nylon 6 cut from one net**

For **structural** purposes – improvement of mechanical properties
What's next?

- Durability of Nylon 6 in concrete?
- Degrading of nets in the waste dump and influence on mechanical properties?
- Pilot testing in the NPA region and long term monitoring of effects
- Collaboration with concrete industry on recipe for use in constructions

Collaboration with Green Tech College, Sisimiut
Thank you for your attention 😊