Knitted textile KTPs for instrumented underwater building systems

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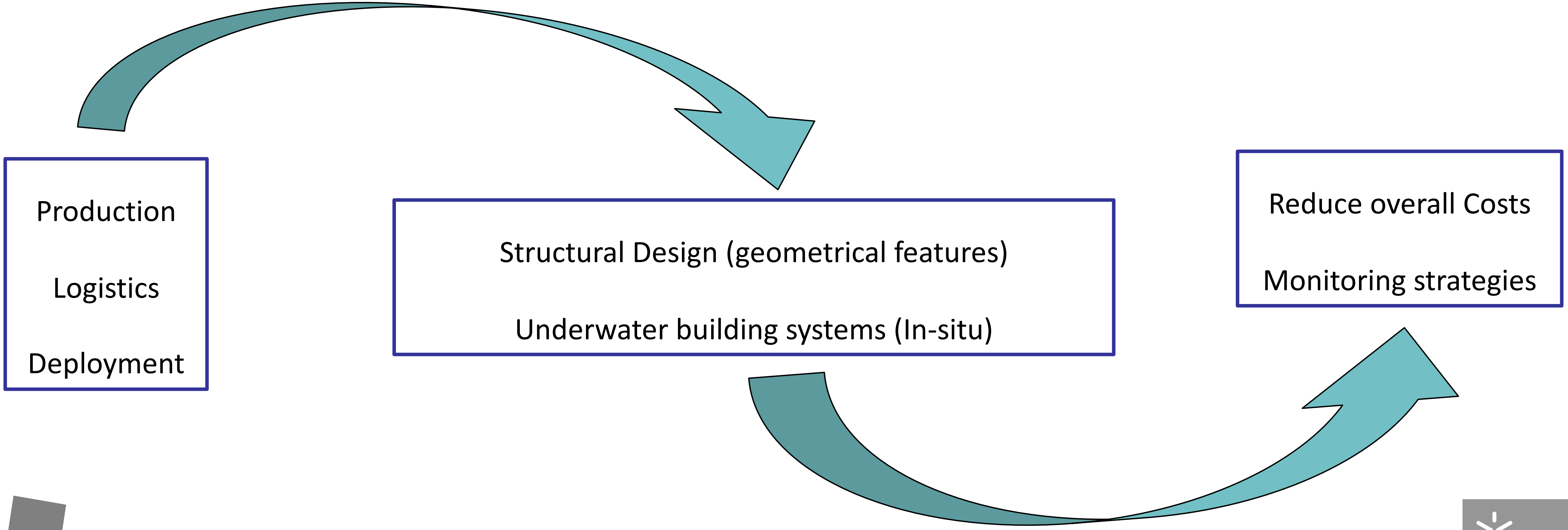
Content

Introduction

The production and deployment of marine-applied concrete structures, such as seawalls, breakwaters, artificial reefs, and other coastal defence structures, using concrete, face several challenges:



Introduction

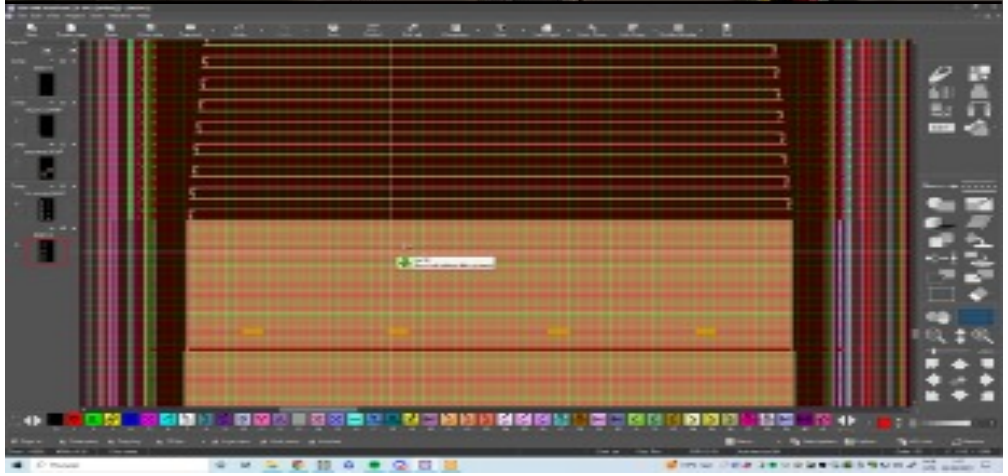
The main scope of this study was to assess the potential of knitted textiles for underwater instrumented underwater building systems, using textile knitted preforms (multi-shape; multimaterial; etc...), using natural fibres (Hemp, Linen and Cotton).

a) Withdraw casting procedures during filling (Free filling using underwater isostatic pressure)

b) Multiscale surfaces (from macro to micro)

Materials & Methods

Knitted textile preform (KTP) Production

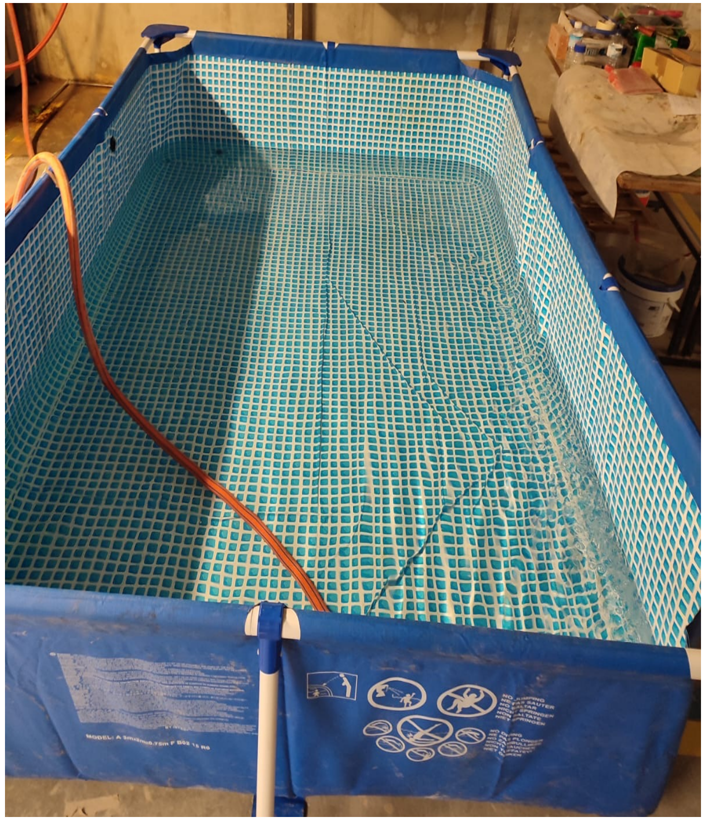


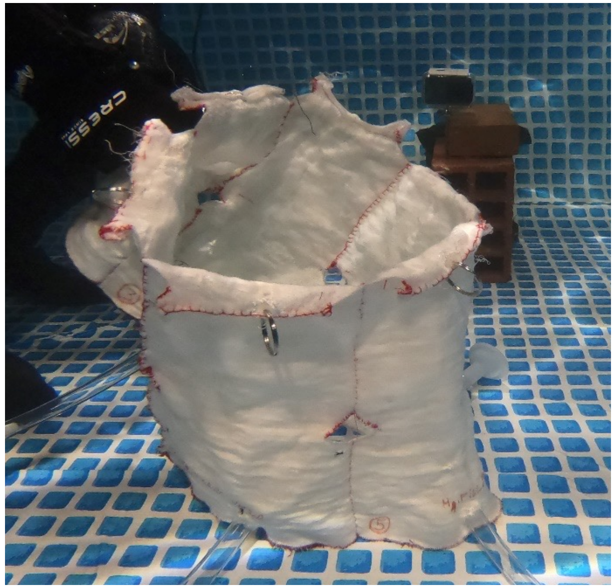
Concrete composition & injection system

Concrete matrix composition

Component	M(%)
CEM II 42.5 R A/L	24,63
Fly ash (FA)	36.9539
Sand	8.6226
Limestone filler	8.6226
Water	18.3142
SP SIKA 3002 HE	1.3945
VMA	0.0647

Materials & Methods





Materials & Methods

Test the influence that materials have on filling leakage

Samples and water tanks

Pressure sensor

After filling

Individual water tanks were used for underwater filling. Water samples were taken after 24h.

Suspended particles analysis

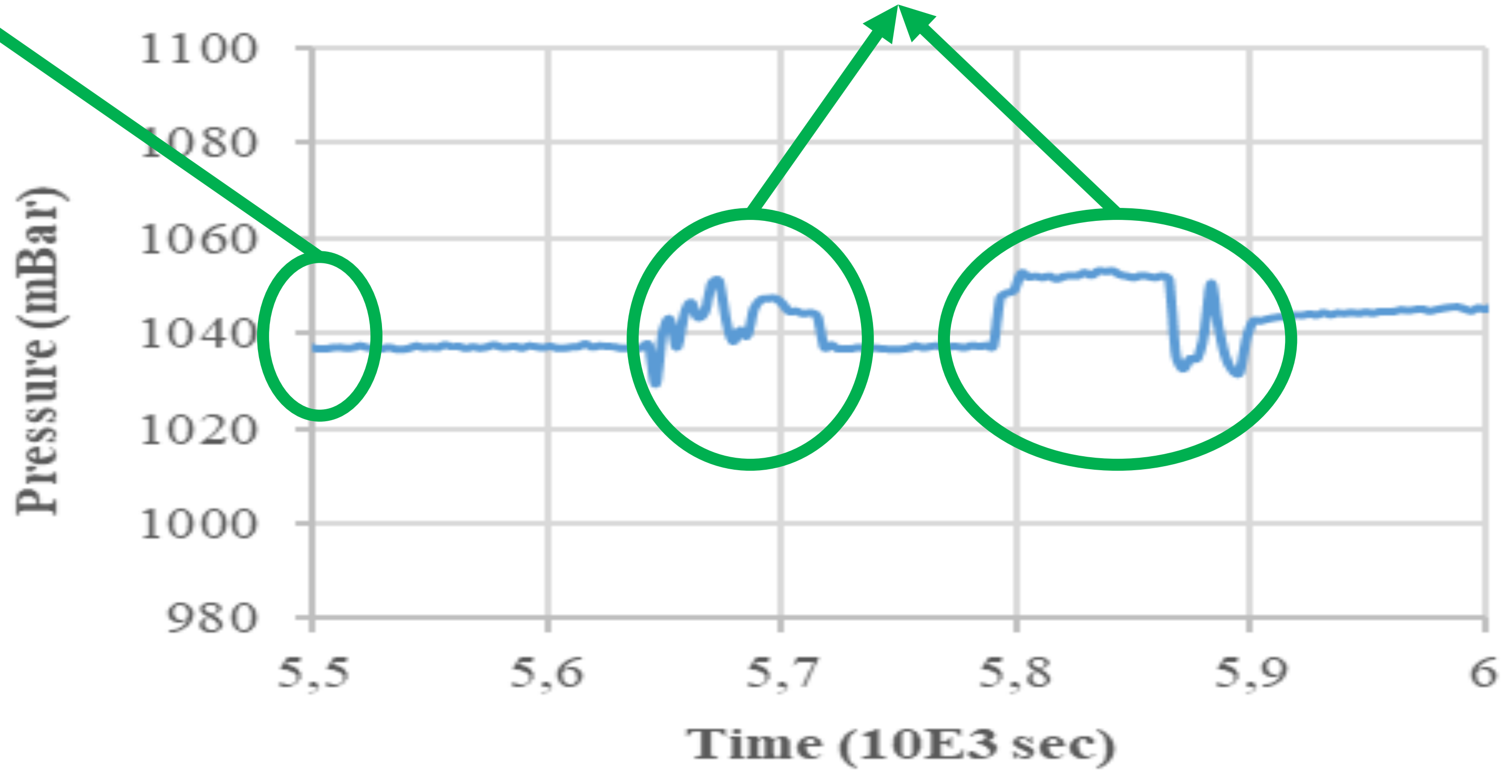
For each KTP type, 3 water samples of 800mL were redrawn, dried and particles weighted

TESTS, RESULTS, AND VALIDATION

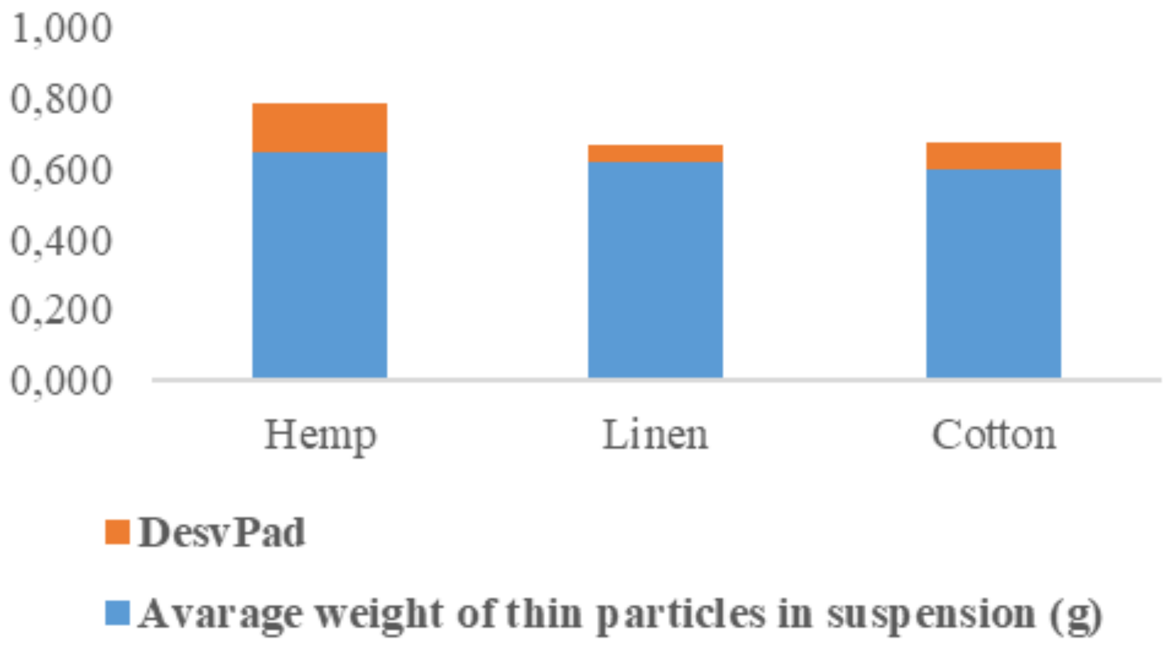
Injection	Duration (sec)	Medium pressure (mBar)
1st stage	159	8.4
2nd stage	114	11.5

Atm pressure (1024mBar + 16mBar)

- Positive and negative pressure increments
- 1st stage of filling was 8.4 mBar
- 2nd stage the average pressure was 11.5 mBar,



TESTS, RESULTS, AND VALIDATION



Sample	KTP (Kg)	Weight of injected cement mortar (Kg)	Weight of the cured specimen (Kg)	weight of fine material that escaped from the KTP (Kg)
Hemp	0,028	2,88	2,299	0,581
Linen	0,028	2,88	2,294	0,586
Cotton	0,025	2,88	2,396	0,484

The water samples were placed in Pyrex cups, dried in a VL2 kiln, from VIDROLAB2 for 70 hours at 60ºC, and the solid particles residuals were weighed.

Conclusions

The main scope of this study was to assess the potential that knitted textiles have for instrumented underwater building systems.

a) – Given the nature of the injection procedure, it was not possible to obtain continuous filling as well as continuous pressure readings and eliminate the effect of the injection strokes on overall pumping pressure.

For future work, a continuous feeding system coupled to an injection cement mortar pump will be tested for larger specimens.

b) – To reduce matrix leaking during filling, there are two possible solutions:

1- Use cotton-like materials, once cotton is less stiff and allows to tighten the knitted structure by closing the loops;

2- Treat the surface of the KTPs, in all three materials, with water repelling natural materials that could decrease water permeability and therefore, reduce the leakage.

Thank you

ACKNOWLEDGEMENTS

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