Africa-Europe Bioclimatic Collaboration 21

Africa-Europe BioClimatic buildings for XXI century

Bioclimatic Materials

جامعة الأخوين
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AL AKHAWAYN UNIVERSITY

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www.abc21.eu

ABC 21 project has received funding from the EU's Horizon 2020 research and innovation programme under Grant Agreement No. 894712.

Review and analysis of materials and construction practices (local and/or adapted to local conditions)

Bio-climatic Materials Studied:

- Earth-based constructions, Adobe, Clay bricks with additives, Rammed earth and Earth-bags construction
- Stone
- Cork-based bricks
- Hempcrete
- Straw, Straw-bale construction and thatched roof
- Typha-based Bricks
- Wood
- Bamboo
- Wool

Methodology Followed during this study

- Properties analysis
- Obtainment process
- Construction practices and methods of application
- Cost assessment of bio-climatic constructions
- Regulations for bioclimatic construction and materials

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Review and analysis of materials and construction practices (local and/or adapted to local conditions)

Earth-based constructions

The adobe

Clay bricks with additives

Rammed earth

The Nubian vault technique

Earth-bags construction

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Earth-based constructions

Material	ρ (g/cm3)	C.S. (MPa)	λ (W/m.K)
Unfired pure clay bricks	1.50 to 2.00	0.35 to 7	0.21 to 0.5
Unstabilized Rammed Earth	1.79 to 2.19	0.81 to 2.46	0.6 to 1.6
Earth Bags	2.19	_	2.18

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Organic residues-based bricks and blocs

Material	Comm.	ρ (g/cm3)	C.S. (MPa)	λ (W/m.K)
Cork	50% cement, 50% cork	0.77	2.65	0.29
	25% cement, 75% cork	0.61	1.72	0.19
Papercrete	Composition: Paper/ Cement/Sand λ and C.S. decrease with increase of paper content	0.4 to 1	1.6 to 5	0.79 to 1.21

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Corck

Stone

	Sandstone	Limestone	Granite	Basalt	Marble	Slate
ρ (g/cm³)	2.00 to 2.53	1.63 to 2.70	2.60 to 2.67	2.68 to 2.71	2.65 to 2.7	2.7 to 3.1
λ (W/m,K)	0.65 to 1.69	0.76 to 2.04	1.34 to 3.69	0.51 to 2.03	1.59 to 4.00	–
C.S (MPa)	25 to 100	25 to 165	130 to 300	115 to 200	75 to 135	90 to 220

House built with stones in Ifrane – Morocco

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Straw bale construction

ρ (g/cm3)	δ (MPa)	λ (W/m.K)
0.06 to 0.18	0.05 to 0.9	0.03 to 0.194

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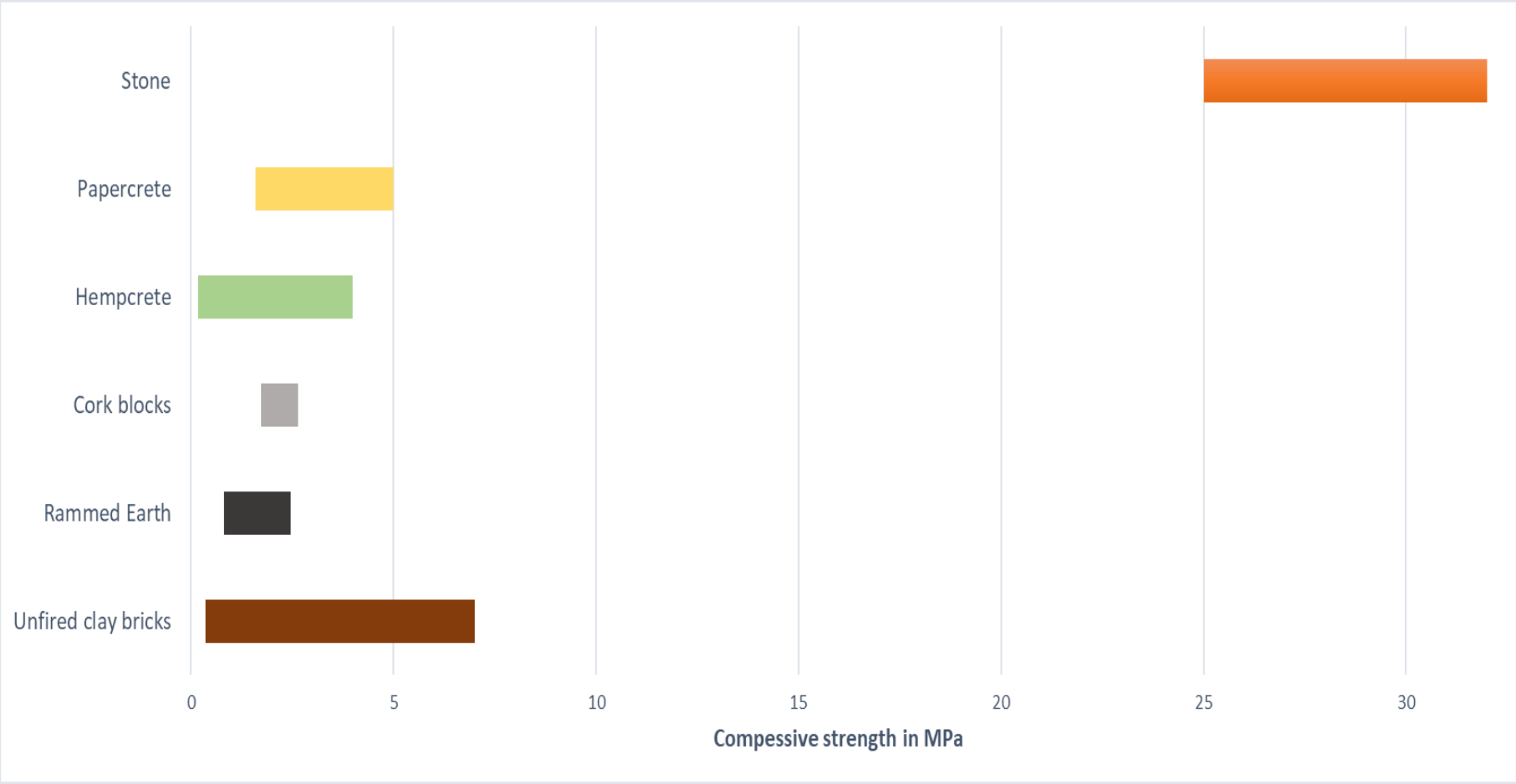
Review and analysis of materials and construction practices (local and/or adapted to local conditions)

Mechanical properties



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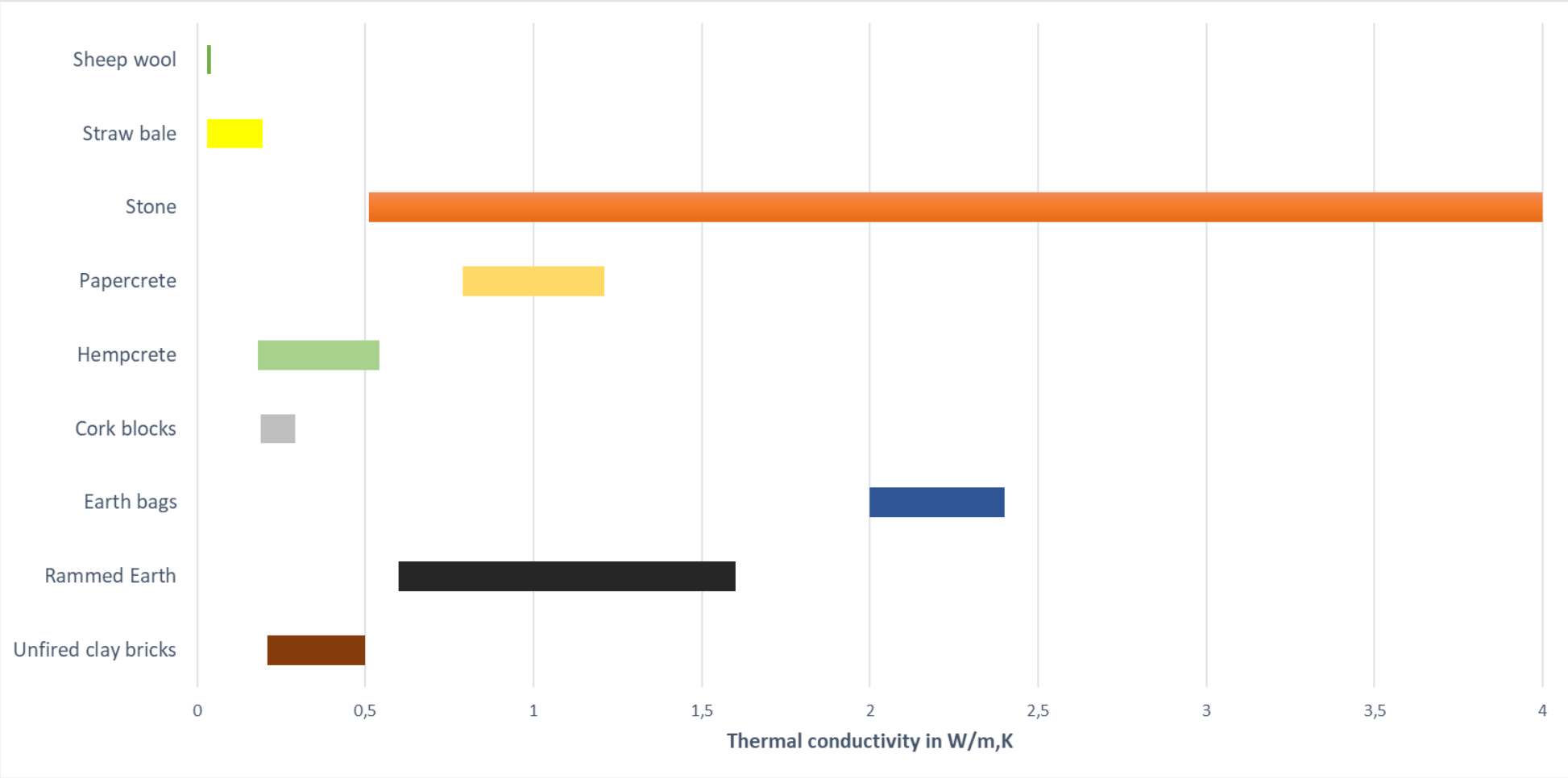

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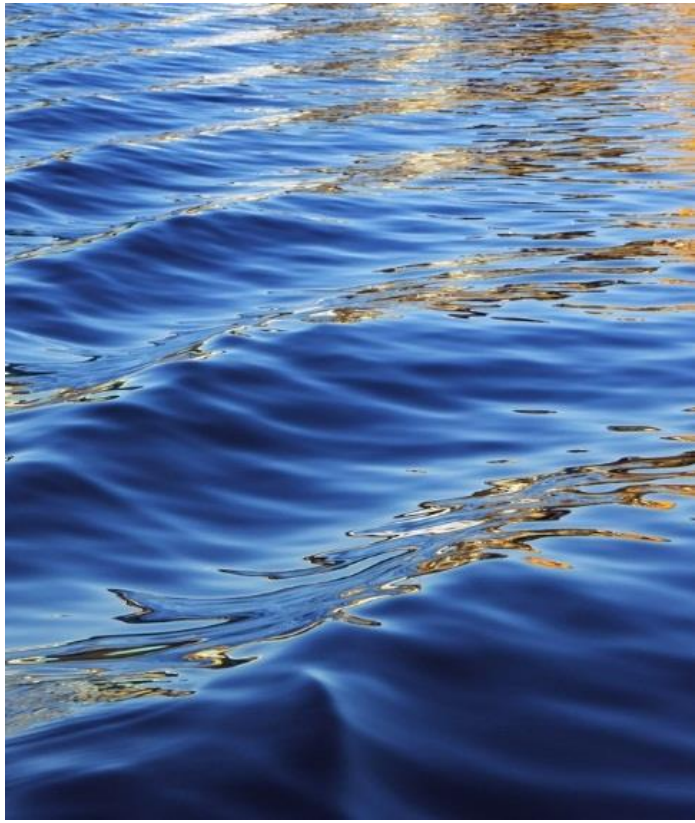
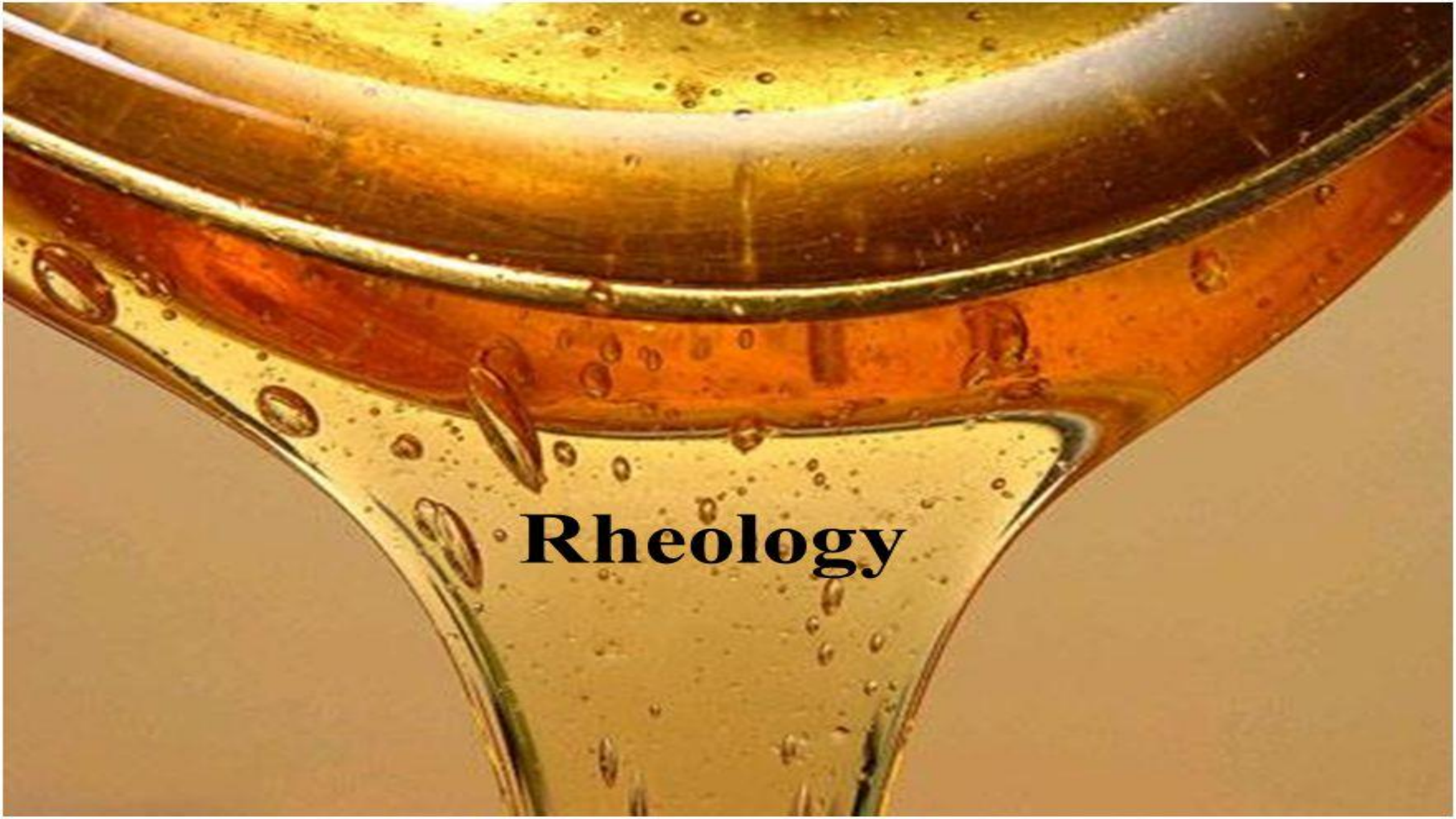
Rheology as a Tool in the Formulation of Stable Bioclimatic Clay Bricks- 6




Rheology

Rheological and physico-mechanical investigations on the destabilization of unfired clay bricks with almond husk additive by salt

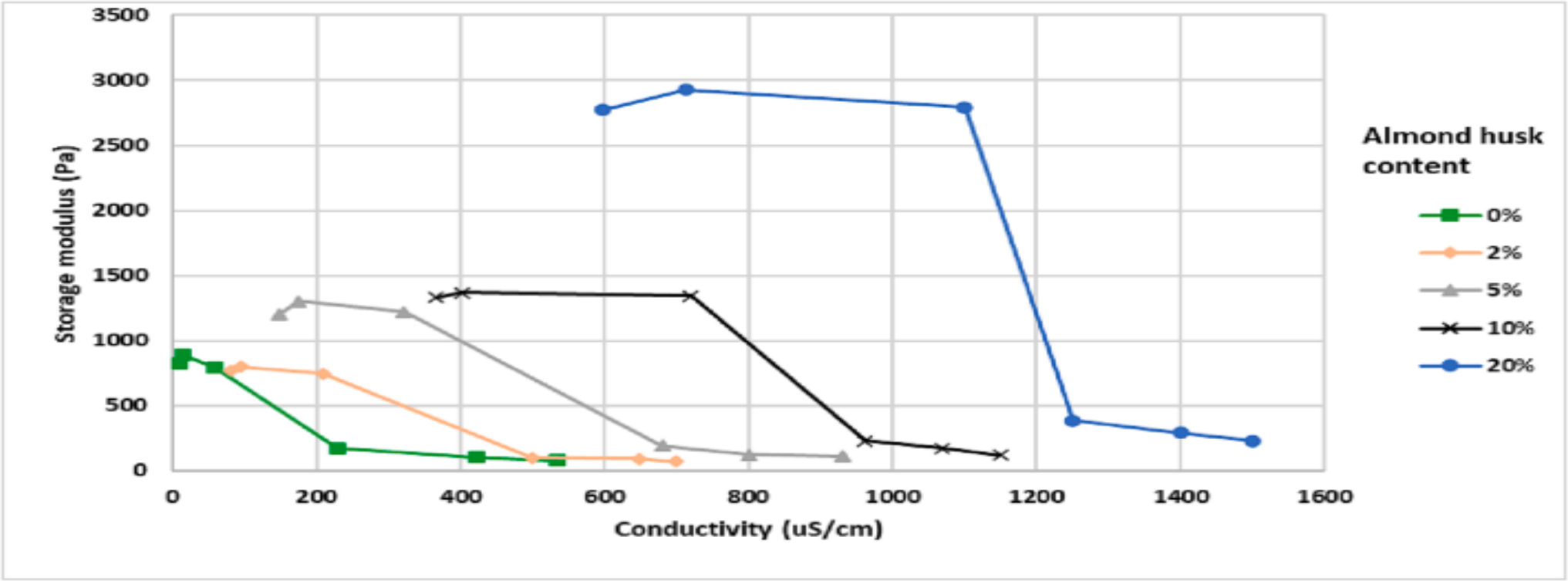


Fig. 5. The storage modulus of the prepared suspensions as a function of their conductivities.

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Rheological and physico-mechanical investigations on the destabilization of unfired clay bricks with almond husk additive by salt

Othmane Noureddine [a b], Imad Manssouri [a], Hassane Sahbi [c], Houssame Limami [b], Asmae Khaldoun [b]

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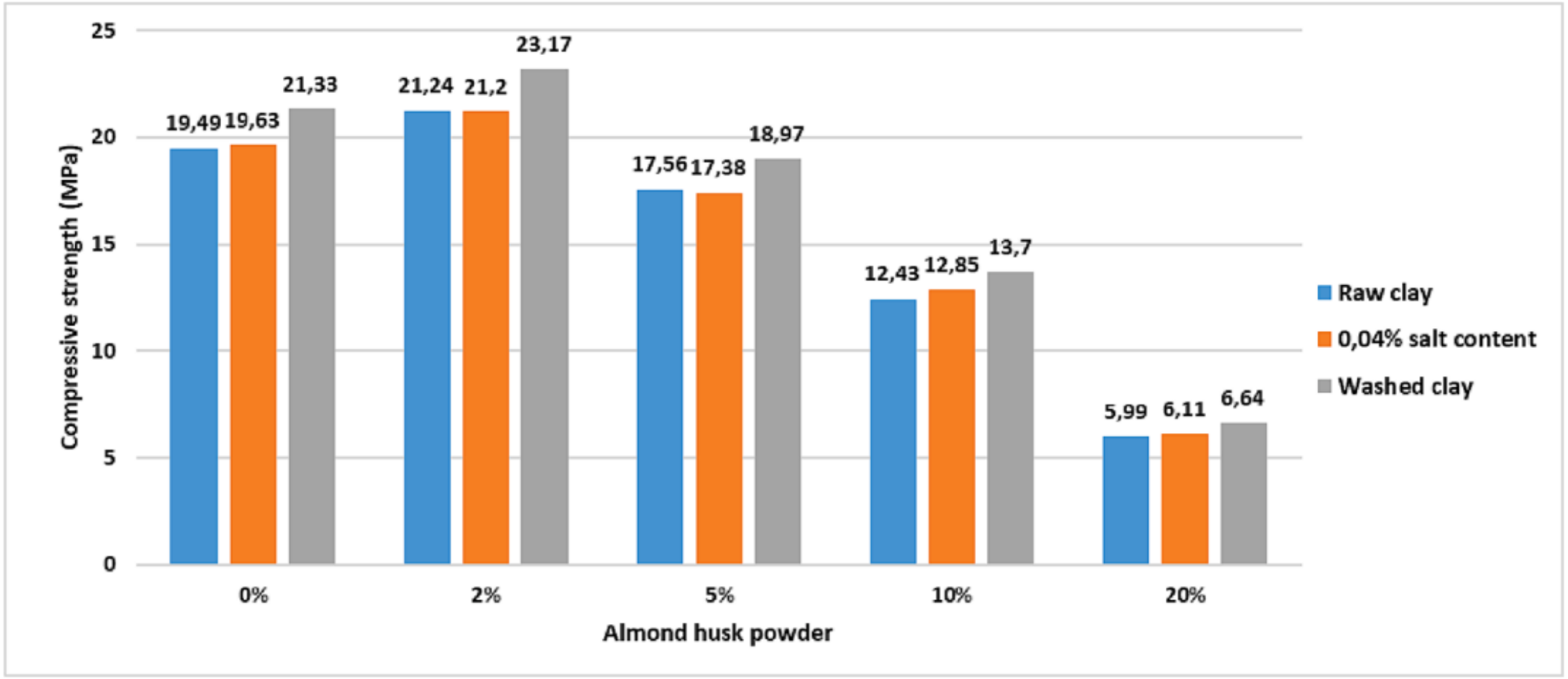

Fig. 7. Results from the compressive strength test on the prepared bricks.

Journal of Building Engineering
Volume 63, Part B, 1 January 2023, 105525

Improving rheological and mechanical properties of non-plastic clay soil from Bensmim region (Morocco) using bentonite additions: Suitability for building application

Ghita El Boukili [a b], Silvia Erba [c], Fatima Kifani-Sahban [a], Asmae Khaldoun [b]

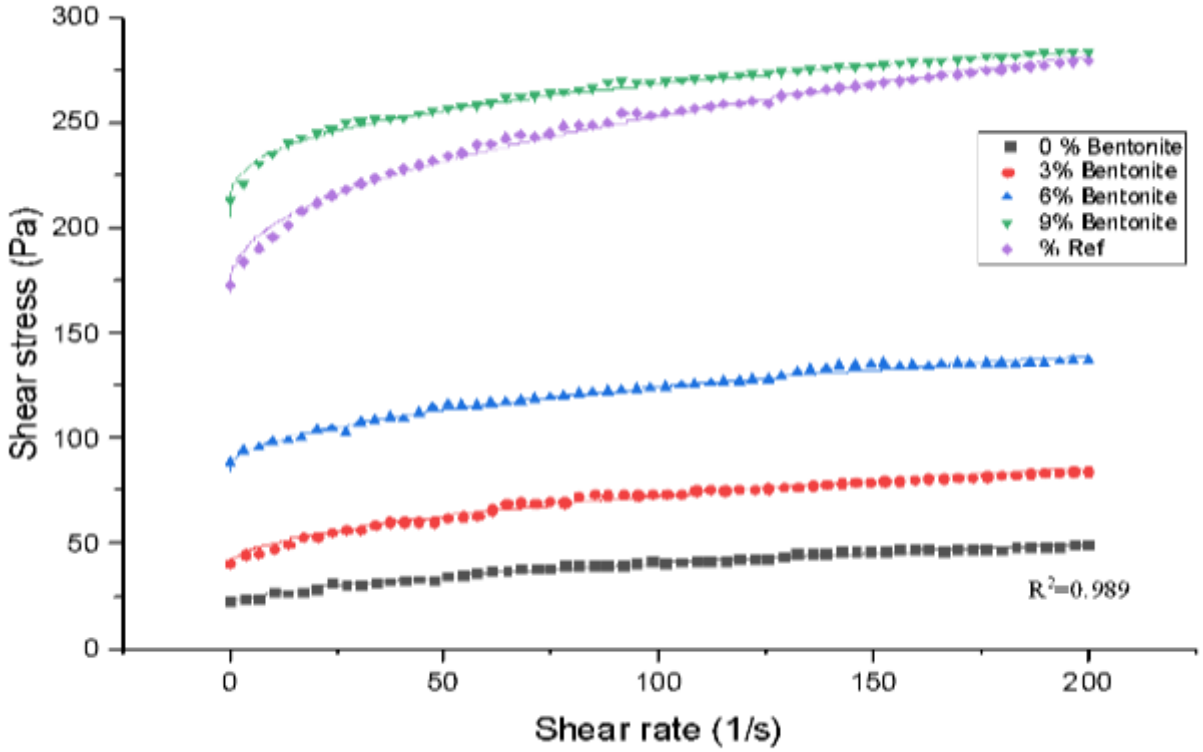

Figure 9. Flow curve of the studied samples

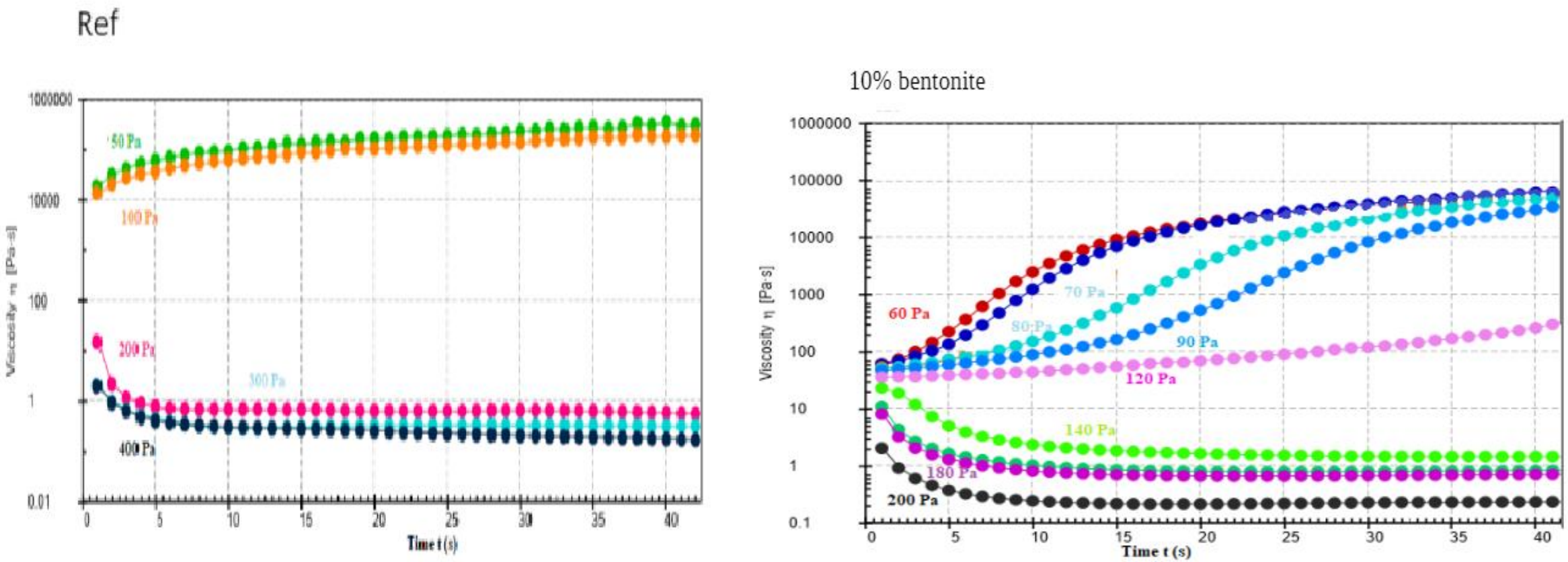

Figure 12. Viscosity bifurcation experiment of the studied samples.

Table 5. Compressive strength variation with Bentonite addition.

	Compressive strength σ_{comp} (MPa)				Measurement error * (%)		
Sample	Test 1	Test 2	Test 3	Mean value	Test 1	Test 2	Test 3
0% bentonite	5.3	5	5.6	5.3	8	1.4	8.4
3% bentonite	6.4	5.99	6.2	6.1	3.7	1.8	1.8
6% bentonite	7.9	8.1	7.6	7.8	5.2	3.4	5.2
10% bentonite	7.8	8.5	8.3	8.2	0.7	2.5	1.8
Ref (EB)	8.5	9	8.9	8.8	0.5	0.1	0.1

Thank you!