



**HAL**  
open science

# Valorization of different biomass ashes and agricultural by-products in the production of concrete

Désiré Ndahirwa, Nathalie Leblanc, Hélène Lenormand, Hafida Zmamou

## ► To cite this version:

Désiré Ndahirwa, Nathalie Leblanc, Hélène Lenormand, Hafida Zmamou. Valorization of different biomass ashes and agricultural by-products in the production of concrete. Journée des doctorants, Apr 2021, Online, France. hal-04261302

**HAL Id: hal-04261302**

**<https://hal.science/hal-04261302>**

Submitted on 26 Oct 2023

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



# JOURNÉE DES DOCTORANTS 2021

## Valorization of different biomass ashes and agricultural by-products in the production of concrete



Désiré NDAHIRWA<sup>1\*</sup>, Nathalie LEBLANC<sup>1</sup>, Hélène LENORMAND<sup>1</sup>, Hafida ZMAMOU<sup>1</sup>

<sup>1</sup> UniLaSalle, Univ. Artois, ULR 7519 - Transformations & Agro-ressources, Normandie Université, 3 rue du Tronquet, F-76130 Mont-Saint-Aignan, France.

\*Corresponding Author: desire.ndahirwa@unilasalle.fr

ADEME



Agence de l'Environnement et de la Maîtrise de l'Energie

### 1. Objectives

- ✓ Elaboration of **alternative bio-based concrete** based on biomass ashes and sunflower aggregates.
- ✓ Understanding **reactivity mechanisms** (relation composition - structures - properties) occurring in concrete mixture : biomass ash-mineral binders-sunflower aggregates

### 2. Goals

- ✓ Promote the **re-use** of locally available **biomass wastes** and encourage the **conservation** of non-renewable natural resources.
- ✓ Elaborate an **affordable** bio-based concrete for building thermal insulation.
- ✓ Reduce the **impact of cement industry** on the environment (greenhouse gases emissions i.e.: CO<sub>2</sub>)

What is the biobased concrete ?

Natural hydraulic lime



Plant aggregates



Copyright : Sika

Unlike conventional concrete (binders, sand, mineral aggregates), the bio-based concrete is composed by binders and plant aggregates

### 3. Raw materials

**Biomass ash** is obtained as a result of combustion of diverse biomass (wood, agricultural waste etc.) at high temperatures. The properties of biomass ash depend on several factors including composition of biomass, temperatures of combustion, collection and storage conditions.

#### Different applications of biomass ash:

- ❖ Soil fertilization agent
- ❖ Production of blended cements, bricks, blocks



- ❖ Cement alternative material in mortar and concrete production

Sunflower bark



Crushed sunflower stem

**Sunflower** is an annual plant, native primarily from North and South America.

In **France**, sunflower is densely cultivated in the **Midwest** and **South-west** regions.

**The sunflower stem** that consists of pith and bark will be used in this study as aggregate.

**Common applications for sunflower seeds** : edible oil and seeds, wild bird food, ornamental in domestic gardens.

Sunflower pith



### 4. Methodology

- ✓ Characterization of biomass ashes and sunflower aggregates : Physical and chemical properties
- ✓ Mechanical performance : Elasticity modulus, Compressive strength, Flexural strength and etc.
- ✓ Thermal performance
- ✓ Morphological characteristics : Structure, Porosity, Form, Shape and etc.
- ✓ Durability and environmental performance : Freeze-thaw cycles, Resistance to chemical and alkali attacks, leaching test and etc.