FEDERAL UNIVERSITY OF BAHIA
POLYTECHNIC SCHOOL

Performance evaluation of a small and decentralized recycling unit as an alternative for construction and demolition waste valorization

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OVERVIEW

City of Salvador is the capital of the state of Bahia
Total resident population of just over 2,9 million inhabitants


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OVERVIEW


ECOPONTO


INERT
LANDFILL


ECOPONTO
Ponto de
Entrega Voluntária


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OVERVIEW


ECOPONTO


CONCRETO
ARGAMASSA
ROCHA
AMOSTRA 1

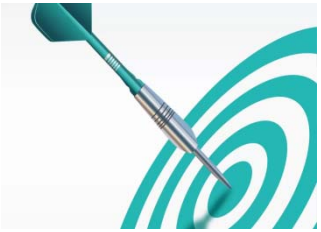

ECOPONTO
Ponto de Entrega Voluntária

OBJECTIVES

Select indicators of environmental and operational performance suitable for smaller and decentralized C&DW recycling units

Get the indicators values in a full-scale site

Perform a characterization of C&DW and recycled aggregates



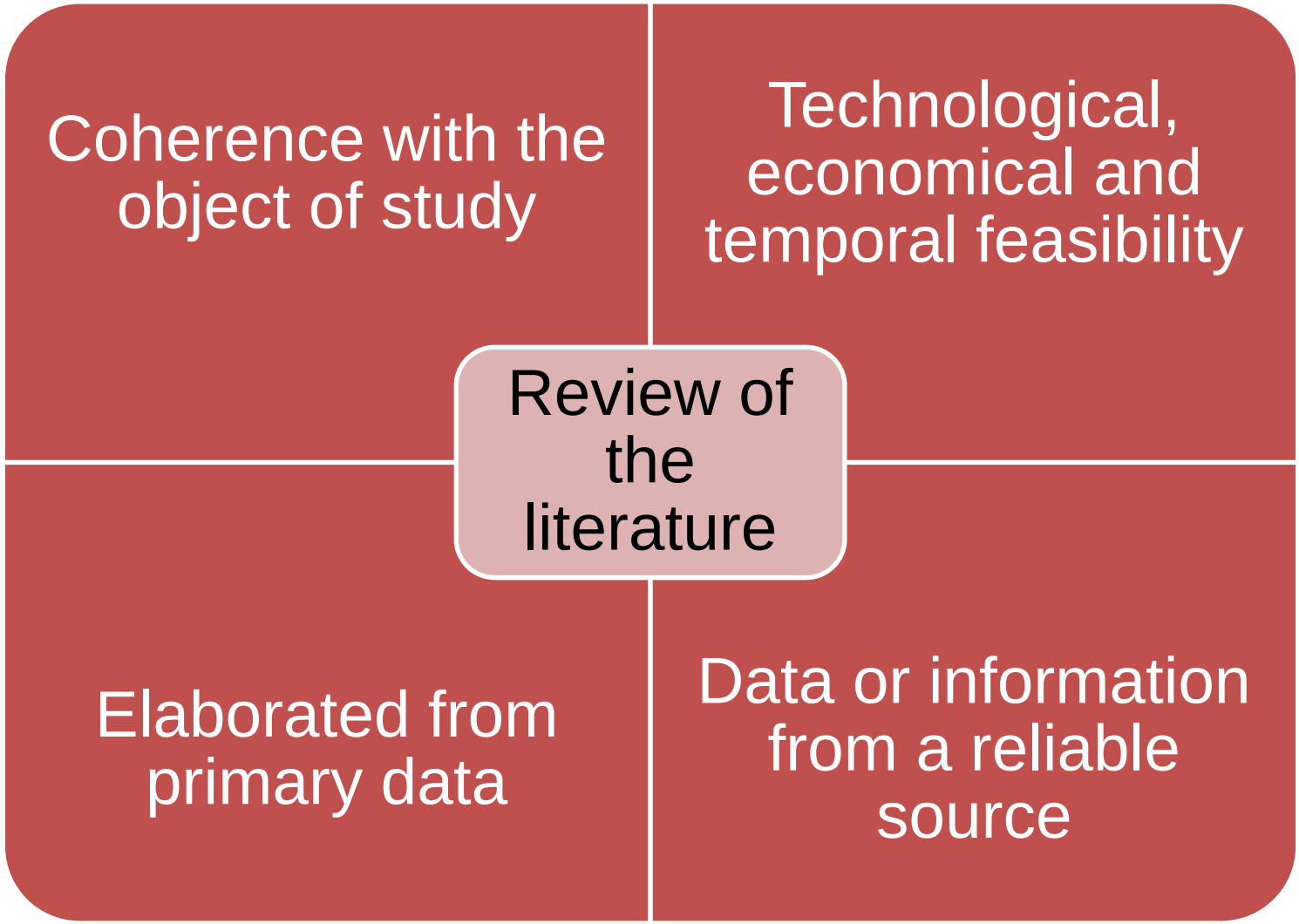
METHODS

Table 1. Main characteristics of the SDRU and of the crushing equipment (*Queixada 200P*)

Description	**Characteristics**
Effective Area	85 m²
Dimensions of the C&DW storage bay	6.2 x 3.8 x 1.7 meters
Dimensions of fine recycled aggregate storage bay	4.0 x 4.1 x 1.7 meters
Dimensions of coarse recycled aggregate storage bay	4.0 x 3.7 x 1.7 meters
Dimensions of the ramp for manual transport of C&DW	3.8m (length):1.0 m (high)
Height of the equipment considering the device for collecting the aggregate	1.4 m
Nominal capacity	1.1 cubic meters per hour
Energy consumption	3.0 kilowatts per hour

METHODS

1. SELECTING THE INDICATORS



METHODS

Total = 115 Indicators

- 48 Environmental aspects
- 38 Operational performance
- 29 Financial performance

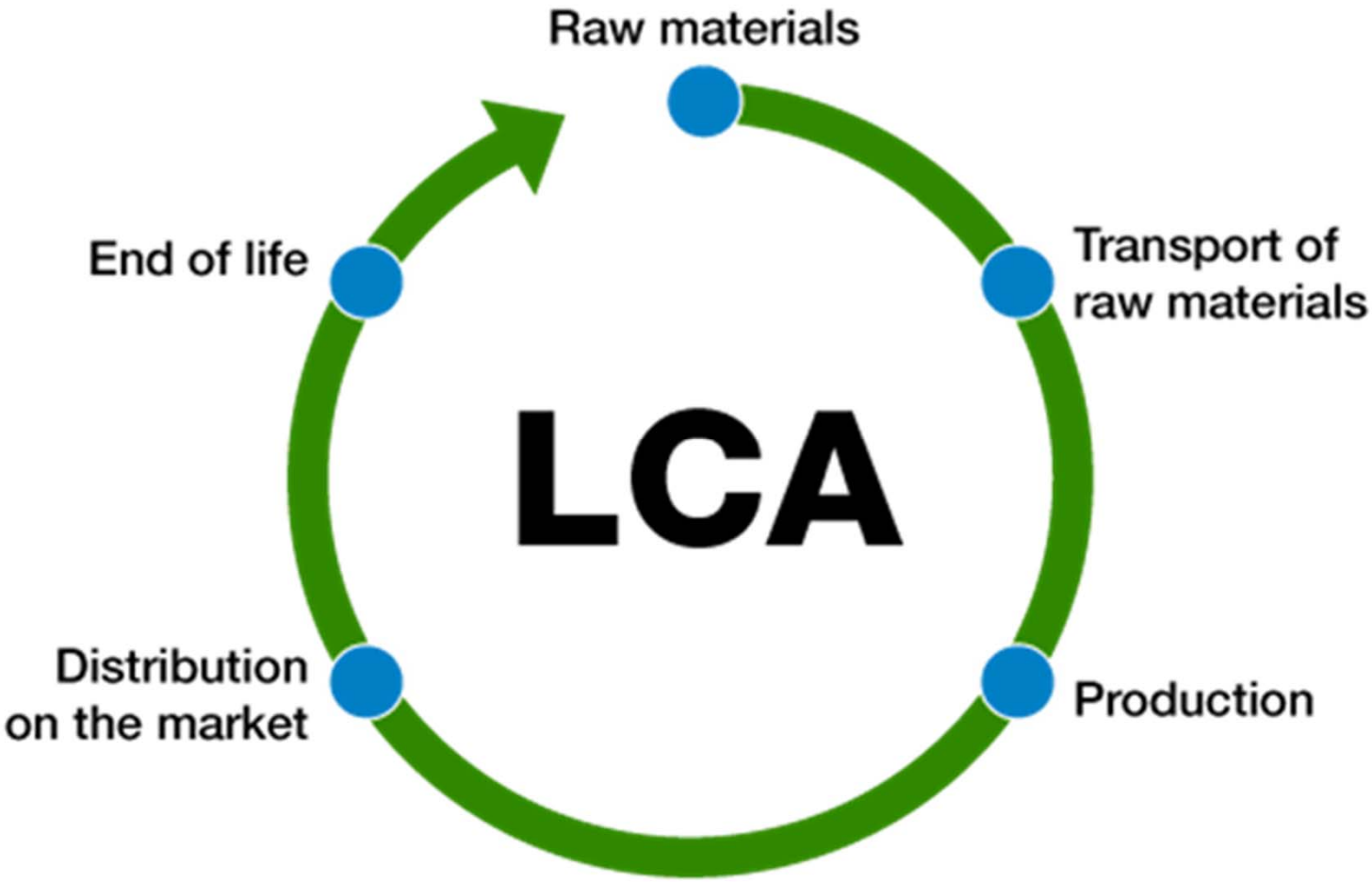
METHODS

4 Environmental performance + 13 Operational perfornace = Performance of the SRDU

Enviromental performance

Indicator	**Description**
Noise emission	Measurement of sound volume (decibels).
Emission of particulate	Mass of pollutant by volume of air ($\mu g.m^{-3}$) measured during the production of recycled aggregate.
Water consumption	Volume consumed per volume of recycled aggregate ($L.m^{-3}$).
Energy consumption	Ratio between the SDRU's energy consumption and the total energy consumption of the construction site.

METHODS


Raw materials
Transport of raw materials
Production
Distribution on the market
End of life
LCA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METHODS


CONCRETO
ARGAMASSA
ROCHA
AMOSTRA 2


CONCRETO
ARGAMASSA
ROCHA
AMOSTRA 1

RESULTS

Table 3. Values of the Indicators selected for environmental performance evaluation of the SDRU

Indicator	**Results**
Noise emission	81.6 dB [(a)]
Emission of particulate matter	TSP =1,460 µg.m^{-3} ([b])
Water consumption	0
Energy consumption[c]	0.16 to 0.62 (%)

Table 4. SRDU's Life Cycle Inventory

Output	**Total**
Fine recycled aggregate	97,539.2 kg
Coarse Recycled Aggregate	144,931.8 kg
Emissions to air	
Particulates	52.7 mg
Input (electricity)	
Electricity, low voltage	260.8 kW


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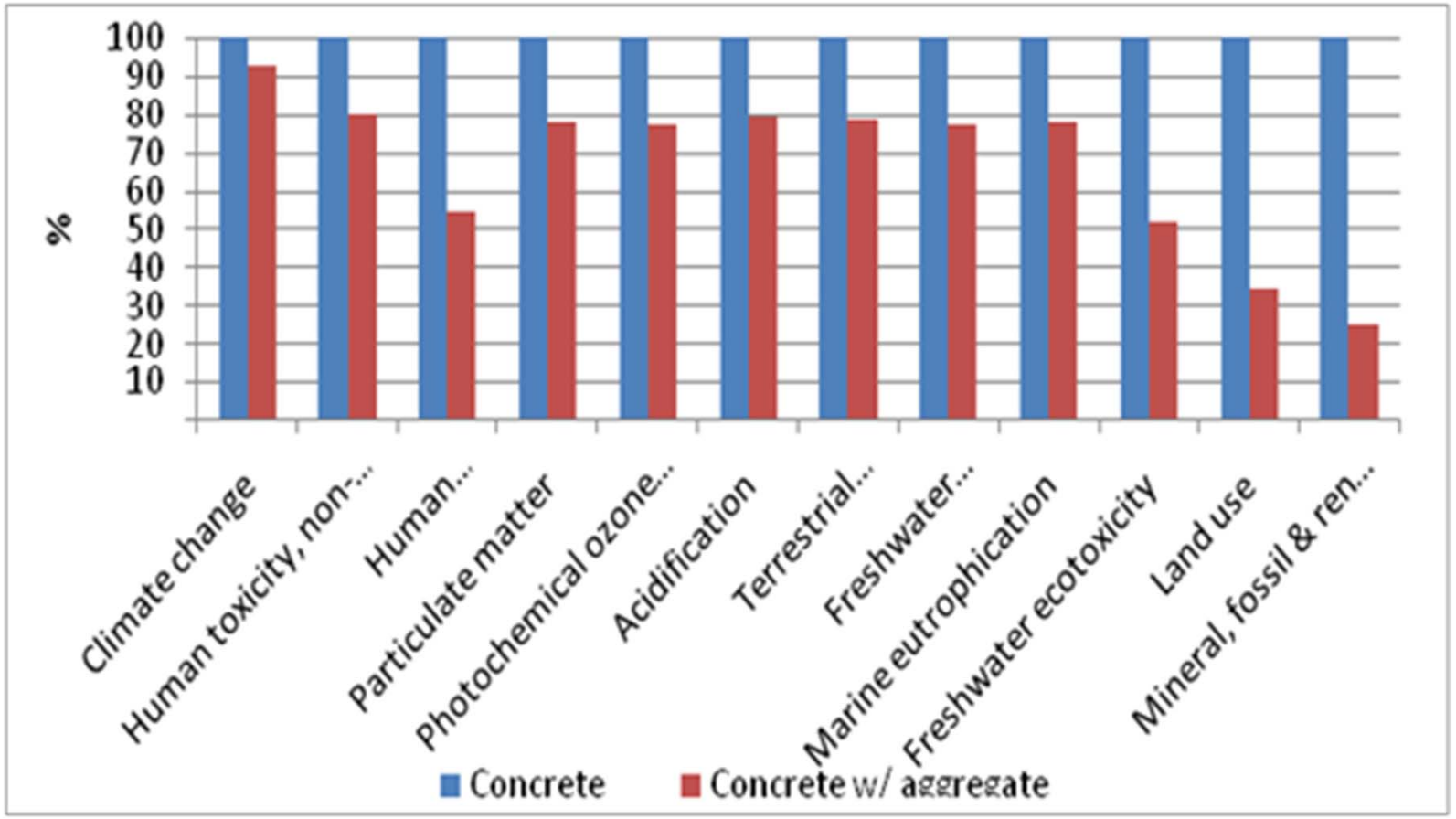
RESULTS


%
100
90
80
70
60
50
40
30
20
10
Climate change
Human toxicity, non-...
Human...
Particulate matter
Photochemical ozone...
Acidification
Terrestrial...
Freshwater...
Marine eutrophication
Freshwater ecotoxicity
Land use
Mineral, fossil & ren...
Concrete
Concrete w/ aggregate

RESULTS

Indicator	Results
Maximum storage time of coarse recycled aggregate	15 days
Maximum storage time of fine recycled aggregate	25 days
Percentage of the time spent for comminution	2.5%
Feeding time of the crusher	0.73h
Flow rate of C&DW crushed	0.5 a 1.1 m^3 per hour
Percentage of coarse recycled aggregate obtained	60.6%
Percentage of fine recycled aggregate obtained	39.4%
Losses during the crushing process	8%
Idleness of crushing equipment in a working day[(a)]	2.4h
Total production time in a working day[(a)]	4.3h
Training time	No training was performed
Quality of raw material	0.05%
Existence of vibration control mechanism requirement for worker safety	No
Protection of raw material to ensure crushing conditions.	No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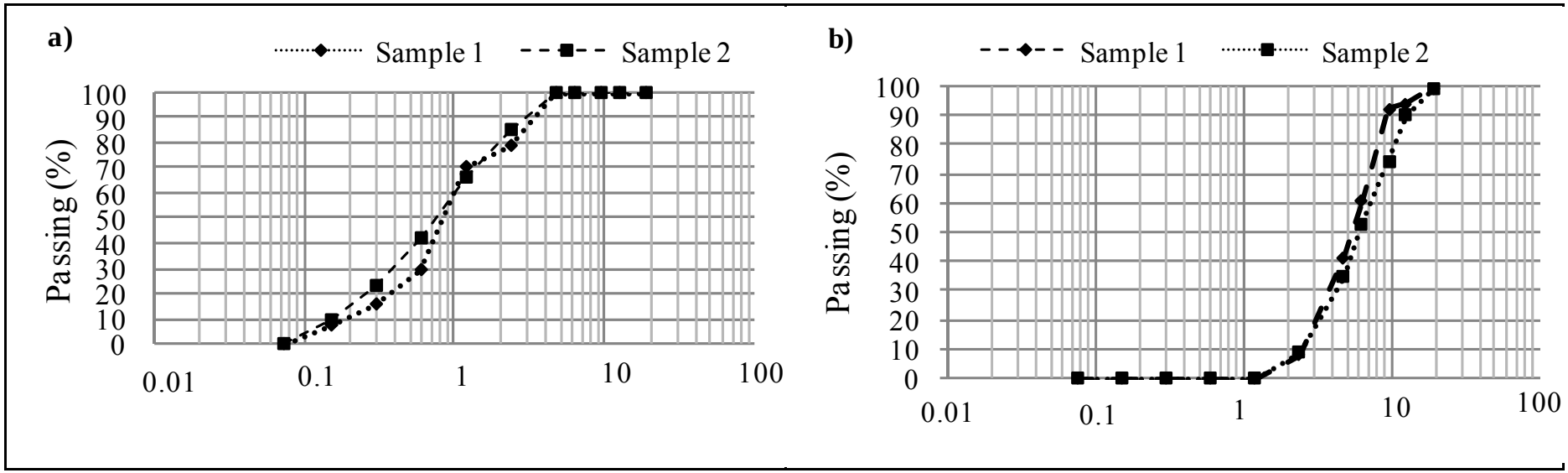
RESULTS


a)
Sample 1
Sample 2
Passing (%)
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
b)
Sample 1
Sample 2
Passing (%)
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100

CONCLUSIONS

The main conclusions were:

1 - A critical review of the literature validated by the judgment of specialists allowed concluding that out of a total of 115 indicators; only 17 are applied to small and decentralized C&DW recycling facilities.

2 -The emission of particulate matter is one of the critical points. Some control measures need to be taken to ensure the safety of the operators of these small and decentralized C&DW recycling units in order to avoid risk factor for the development of cardiovascular and respiratory diseases.

3 - Applying the Lyfe Cycle Assesment approach, it was concluded that the use of the recycled aggregate in the manufacture of concrete without structural function resulted in a decrease of environmental impacts in all the categories considered.

4 - The results allow to state that the recycled aggregates obtained from the SRDU have great potential for use and valorization.

GRSE
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da Universidade Federal da Bahia

Thank you for your Attention!!

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