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"COMPARISON OF STRENGTH PARAMETERS BY REPLACEMENT OF FINE AGGREGATES WITH CRUSHED C&D WASTES IN CONCRETE"

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ABSTRACT *:* Waste material which is generated during construction and demolition include a mixture of masonry waste (brick, sand, gravel, and stone), concrete waste etc. Reuse of these waste material by converting them into aggregates that can be used for construction activities. This reduces extraction of natural aggregates and saves landfill space. The concept of sustainable construction implies recycling of waste materials obtained from demolition of structures/buildings. Such demolition waste can be crushed to the required sizes and partially replaced with natural aggregates in construction.

Key words : construction and demolition waste, masonry, M-sand

I. INTRODUCTION

1.1 GENERAL

In urban areas there is extensive use of river sand, in major construction activities like mortar and concrete. With this there is shortage of river sand in upco ng countries, for developing the infrastructure of the country. Due to this reason developing countries like India is facing a shortage of good quality river sand.

Simultaneously in other side construction/demolition (C&D) waste generated by the construction activities due to demolition, remodeling, building, subway, bridges and Flyover etc. In which the waste consists of inert and Sustainable materials like concrete, mortar, wood, metal, bricks, masonry etc. are dumped in low-lying areas has landfills. It is estimated that construction industry in India generates 10-12 llion tons waste (nistry of Environment and Forest, 2010). Projections of construction in housing sector are facing a shortage of aggregates for construction activities.

Recycling of aggregate material construction and demolition waste leads to maintain a demand and supply gap between these sectors. Retrievable material like brick, wood mortar, concrete and masonry accounts more than 50% of the C&D waste which is presently not recycled in India. But other countries are recycling this materials and reusing for various construction activities.

Nowadays thin bed masonry construction is practiced in many countries in order to reduce the volume of materials required for the construction, cost reduction and also speeds up the construction process. Practically maintaining uniform thickness is very difficult in each layer of construction of thin bed masonry whose thickness of bed varies from 3mm to 5mm. hence for this reason there is a need of developing a tool which will facilitate to maintain the uniform mortar thickness

1.2 MASONRY

Masonry refer to arrangement of masonry units one over the other with mortar as a adhesive agent between the units. Depending on the type of masonry unit used the masonry is classified into Brick masonry, Stone masonry and Block masonry.

1.3 MORTAR

Mortar is the second and equally important, ingredient of masonry besides the masonry units. Fresh mortar is a uniform xture of cement, water and fine aggregate xed well to get a uniform consistency. Role of mortar is to provide better bonding between the masonry units, so that it act as monolithic structure. The selection of mortar depends on type of masonry unit, strength and exposure conditions.

In present study an initiative is taken to eli nate the river sand completely with construction and demolition waste which is obtained from local dumping yard. By reduced joint thickness one can able to reduce the construction cost.

IS 2250:1981[1] - Guidance for preparation and use of masonry mortar.

1.4 OBJECTIVES OF THE PRESENT STUDY

- The present work aims to
- Identify an alternative to river sand/ Manufacture sand (M-Sand) in mortar.
- Investigate the masonry properties such as compressive strength, flexural strength and modulus of elasticity of stack bonded and English bonded prisms.
- Investigate the effect of joint thickness on the strength of masonry by using various mortars.
- Deter ne the cost of construction per unit volume of masonry structure.

1.5 SCOPE OF THE WORK

- Due to increased activity of construction followed by demolition leads to lot damage to the environment because of dumping the C and D waste in low lying areas and free spaces.

- To reduce this hazard to environment the only possible solution is to recycle and reuse the materials which has been used for construction activities, but 50% of waste not be recycled it requires further developments to recycle. And it is essential to develop an interest towards alternative aggregates in various applications of construction.

- Various types of waste produced in environment among those in present study only C and D waste has been selected for preparation of prisms and mortar.

- In present research work the alternative material C and D waste is used partial replacement to the fine aggregate, i.e. M-sand. The present study is on mortar of Cement: Concrete waste (CW) 1:4 (30% and 50% replacement to FA), Cement: Masonry waste (MW) 1:4 (30% and 50% replacement to FA), Cement: Concrete and Masonry waste (CW-MW) 1:4 (30%-30% replacement to FA) and it is compared with conventional Cement: M-sand 1:6. From this research work intends to contribute to the waste management in preservation of environment and exhausting resources.

II. MATERIALS AND METHODS

2.1 GENERAL

This chapter provides detailed methods considered while conducting the project work. Along with the materials that have procured and tested.

2.2 MATERIALS

- Ordinary Portland cement (53 Grade)
- Manufacture sand (M-sand)
- Concrete waste (CW)
- Water

2.3 TESTING OF MATERIALS

Materials to be tested,

- Cement
- M-Sand
- Concrete waste
- Water

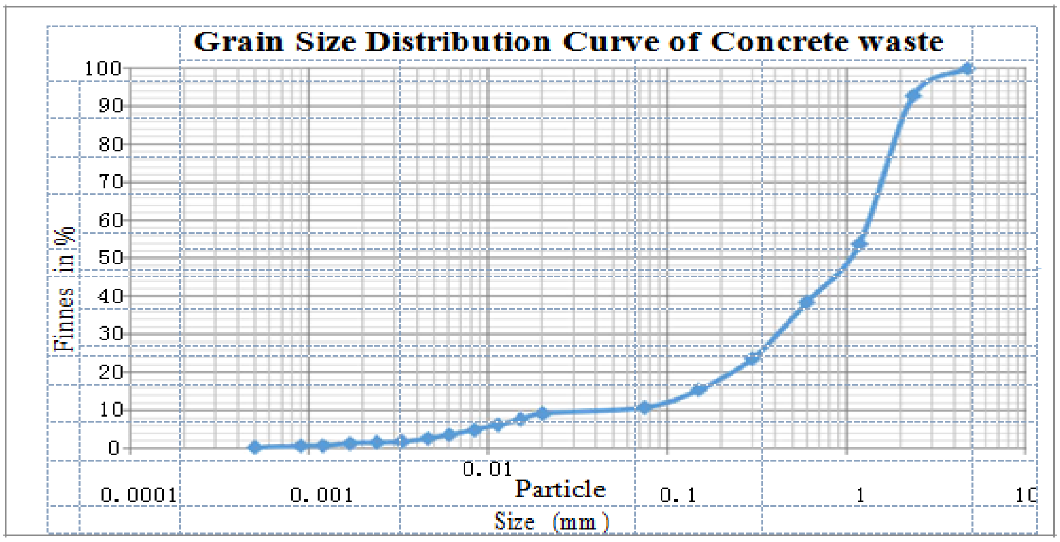
Sl No	Materials	Normal Concrete 100%M-Sand	Mix 1 100% C&D 0% M-Sand	Mix 2 50% C&D 50% M-Sand
1	Cement	311	311	311
2	Coarse aggregate	1262	1262	1262
3	Manufactured Sand	807	0	403.5
4	C&D Waste	0	807	403.5
5	water	140	140	140
6	Super plasticizer	6.22	6.22	6.22

Table 1: Mix proportion for 1m^3 concrete

Sl.No	Details of Properties	Result	IS 12269: 1987
1	**Fineness**	**5.14%**	**<10%**
2	**Initial setting time**	**180 minutes**	**$\geq$ 30 minutes**
3	**Final setting time**	**360 minutes**	**$\leq$ 600 minutes**

4	**Standard consistency**	**27%**	**-------**
5	**Specific gravity**	**3.12**	**-------**
6	**Compressive strength at 28 days**	**56 Mpa**	**≥ 53 MPa**

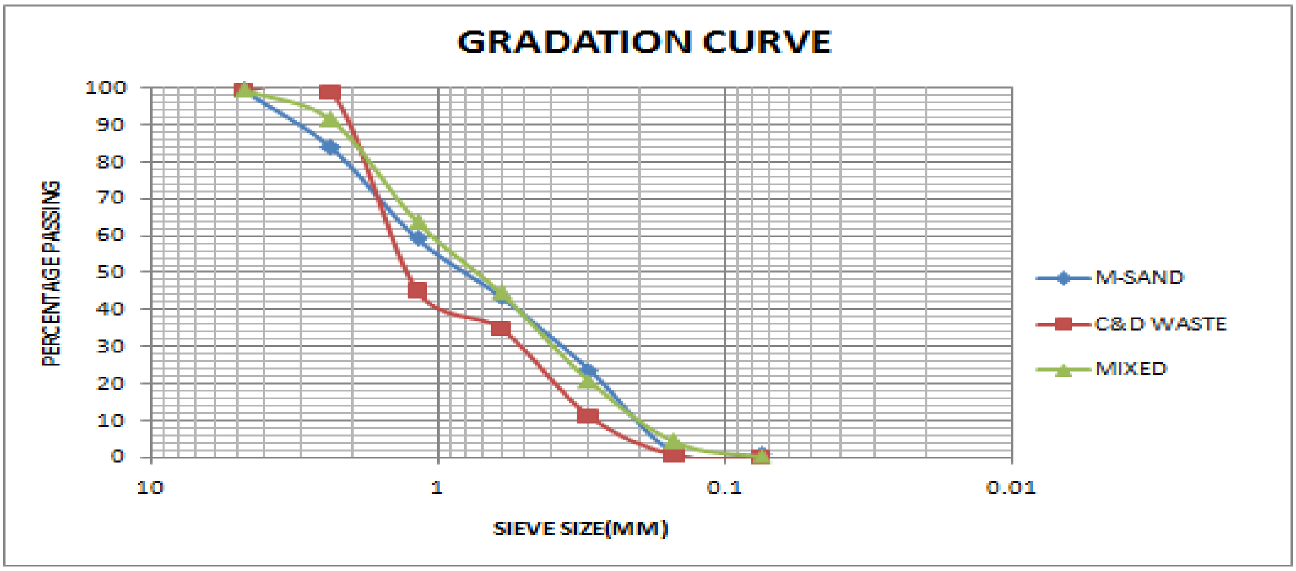
Table 2 Physical properties of OPC – 53 Grade



Graph 1: Grain size distribution of Concrete waste

Clay	Silt	Sand	Gravel
2%	7.98%	89.84%	0.18%

	PERCENTAGE PASSING		
SIEVE SIZEV(mm)	M-SAND	C&D WASTE	MIXED
4.75	99.6	99.4	99.7
2.36	83.9	98.9	91.5
1.18	59.4	45.1	63.8
0.6	43.5	35	44.7
0.3	23.9	11.2	20.8
0.15	1.5	0.6	4.3
0.075	0.8	0.1	0.5
PAN	0	0	0



Graph 2: Gradation curve for Fine aggregate

III. RESULTS AND DISCUSSION

Sl No		Compressive strength		
		7 days	14 days	28days
1	Normal concrete	19.11	27.77	35.12
		18.88	27.11	33.64
		18.44	26.18	36.52
2	Mix 1	18.19	25.12	37.42
		19.09	28.54	34.87
		17.78	26.89	35.43
3	Mix 2	18.97	29.55	34.12
		18.42	28.46	36.15
		17.84	26.13	37.48

Table 3.Compressive strength

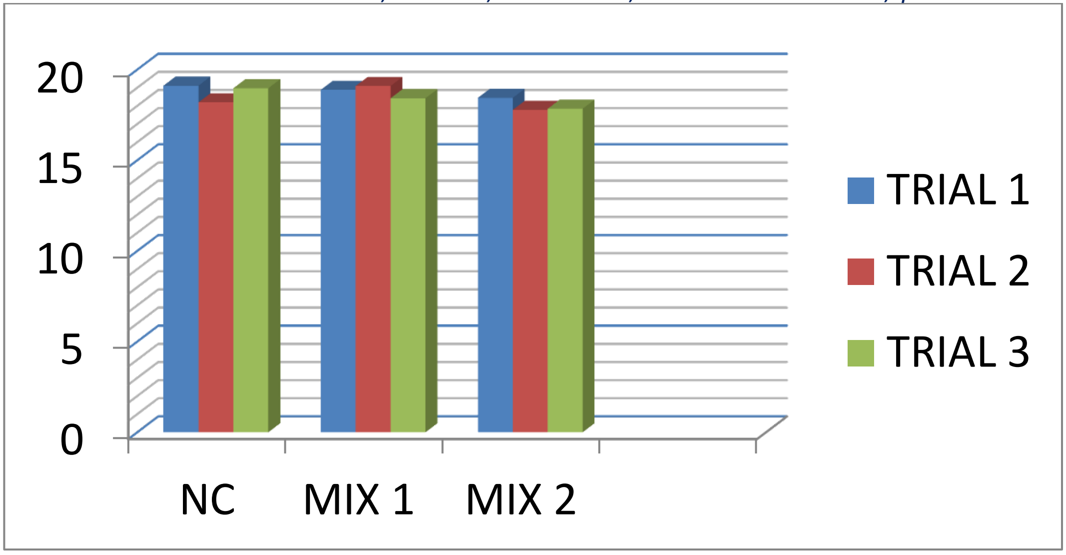


Fig 1.compression strength variation of different mixes (7 DAYS)

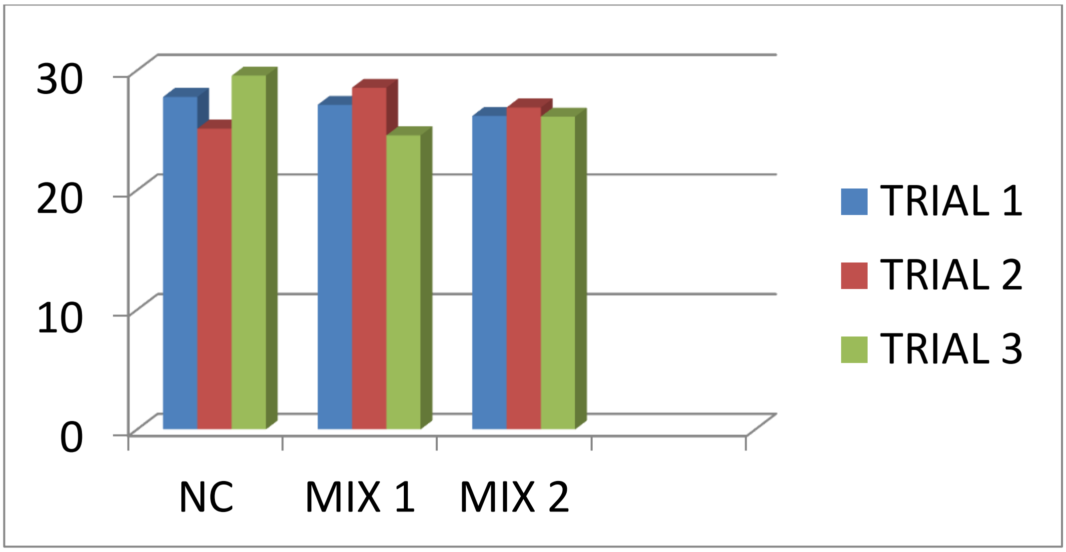


Fig 2.compression strength variation of different mixes (14 DAYS)

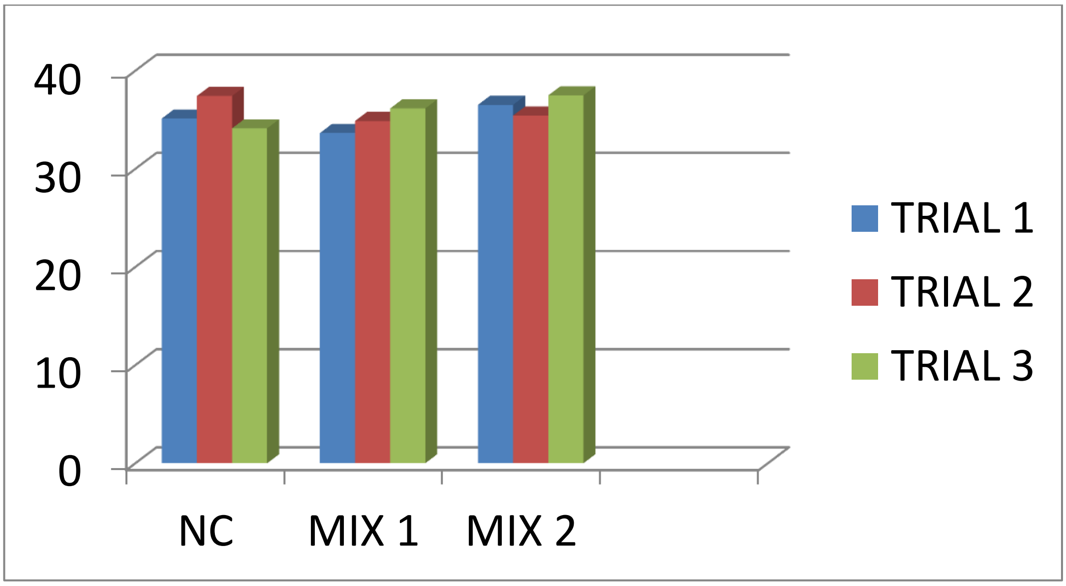


Fig 2.compression strength variation of different mixes (7 DAYS)

Sl No		Tensile strength		
		7 days	14 days	28days
1	Normal concrete	2.39	2.97	3.84
		2.36	3.01	3.87
		2.3	2.89	3.75
2	Mix 1	2.32	3.02	3.92
		2.06	3.10	3.84
		2.18	2.90	3.76
3	Mix 2	2.31	3.14	3.76
		2.09	2.94	3.79
		2.23	2.91	3.94

Table 4.Tensile strength

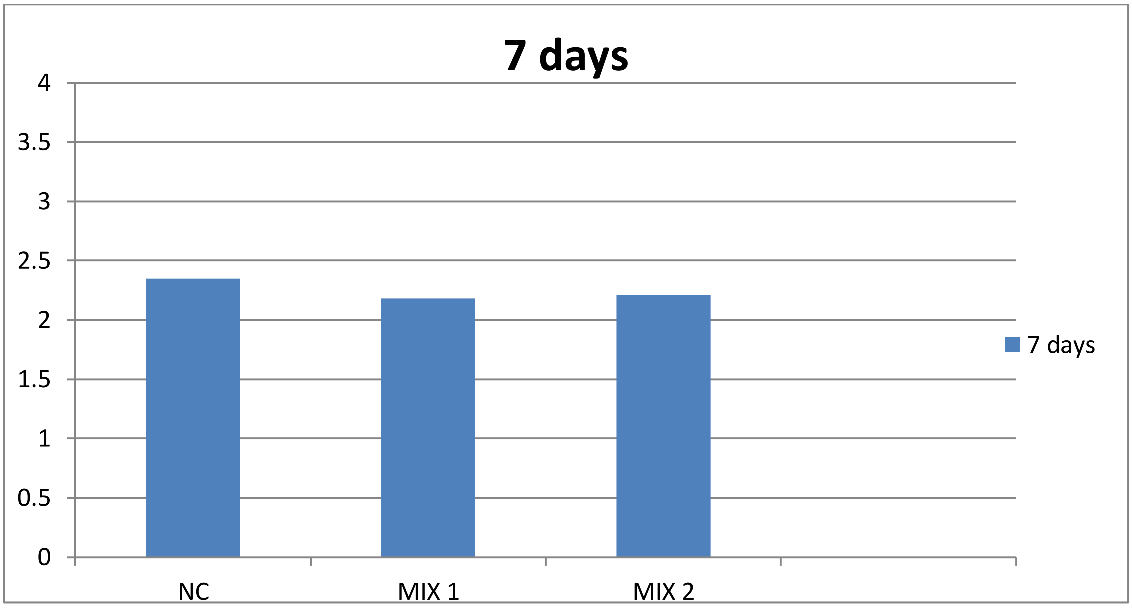


Fig 4.tensile strength variation of different mixes(7DAYS)

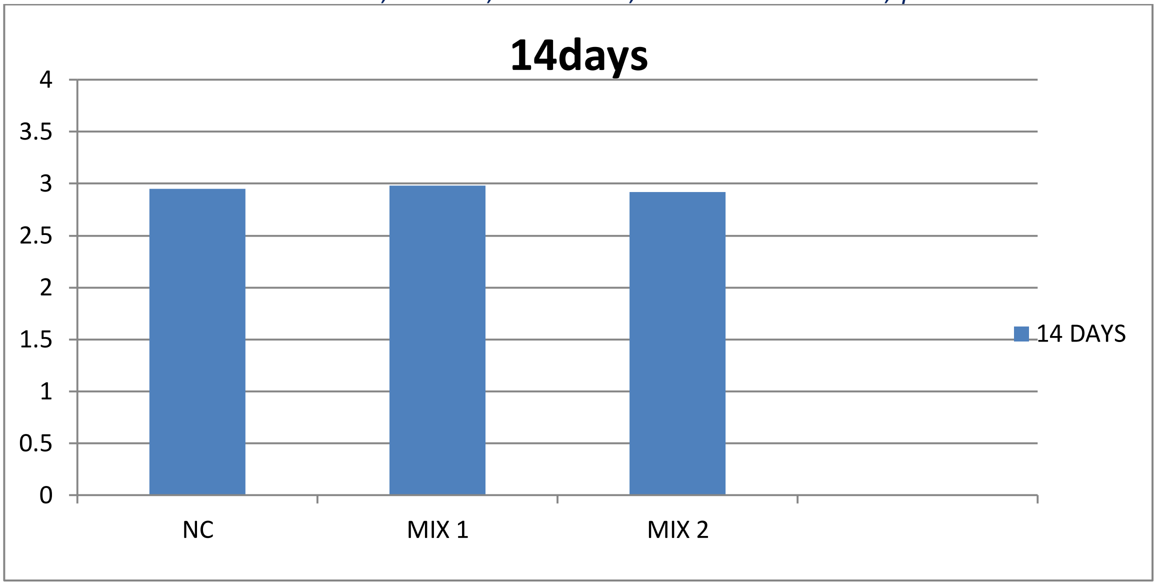


Fig 5.tensile strength variation of different mixes(14 DAYS)

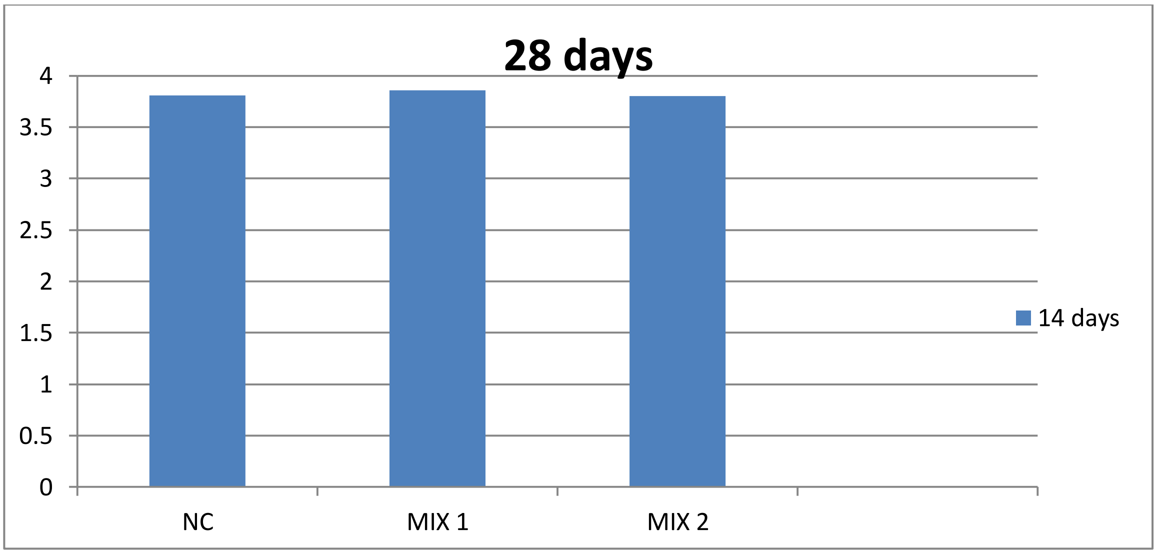


Fig 6.tensile strength variation of different mixes(28 DAYS)

IV. CONCLUSION

- The physical property of masonry waste was determined. The results showed that masonry waste can be used as fine aggregate material in production of concrete masonry unit.
- The specific gravity of masonry waste was 2.57 and M-sand was 2.59.
- The water absorption of masonry waste was 5.6% slightly higher than M-Sand which was 3.68%.
- The fineness modulus of masonry waste was 3.43 and that of M-Sand was 3.06.
- The grain size distribution indicates that masonry waste and M-sand conforms to zone-2.
- The compressive strength of 50%REP block at 14 and 28day was in the range of 5.7 to 6.55 MPa. Higher than the minimum compressive strength as per IS 2185 2005 (Part-1).
- The flexural strength of 50%REP block at 14 and 28day was in the range of 1.85 to 2.21 MPa.
- The initial rate of absorption of 50%REP was 1.43, 2.88 and 1.97 kg/m²/min.

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