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RESEARCH ARTICLE

VALORIZATION OF MATERIALS FROM ROAD WASTES: CASE OF THE SEASHELL AGGREGATE

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Abstract

The main objective of this study is to see to what extent it is possible to recover a material from road waste: the case of the seashell aggregate. Public works produce 100 millions tonnes of surplus and construction waste every year. Among the 100 million tons, 95% is inert and non-polluting waste. And faced with the ever-increasing demand for road construction materials and the scarcity of materials satisfying the specifications, it is urgent to initiate study programs on the possibility of using the materials in place in order to anticipating the total exhaustion of careers. In road works, and in particular for making embankments and capping layers, the bearing capacity of the soil, i.e. its resistance to rupture, is determined by the test C.B.R. (Californian Bearing Ratio) or Californian lift test. Thus, after characterization, the seashell aggregate from road waste was improved with Portland cement with different percentages. We find with a treatment at 1.5% then 2.5% respective CBR values of 94 and 140. This work shows that these materials can be reused in road construction.

Introduction:-

At a time when energy is becoming more and more expensive, public works laboratories must show imagination and promote the use of local materials under the best conditions in order to minimize the cost of road construction while remaining within acceptable safety limits. Inert waste (for example in the form of ballast, cuttings and materials from pavements) represents a source of materials that the road must know how to exploit and recover.

The evolution of environmental acceptability is a subject that has been the subject of debates and working groups in order to develop a methodological guide for the acceptability of alternative materials. Alternative material (AM) is defined as “any material produced from waste and intended to be used, alone or mixed with other materials, alternative or not” [1].

Currently, public authorities and sub-regional and international institutions seek to promote trade and reduce poverty in Africa through the development of road infrastructure and the management of inter-African trade corridors

However, in Senegal there is a scarcity of conventional materials (laterite) for road construction projects. This has an impact on the costs of operating quarries and transporting materials [2-3]. It is therefore up to the road engineers to

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find materials that can be substituted for the more economical conventional ones while maintaining the quality hence the idea of reusing the seashell aggregate from road waste.

In Senegal, the most important deposits of seashell aggregate (shell piles) are found in the northern part, more precisely around the region of Saint Louis which includes the quarries of Rao, Gandon and Bango [4]. In this area, most of the pavements have been made with seashell aggregate.

Our attention is focused on the improvement of the seashell aggregate waste with cement to have the CBR values to compare with those specified [5].

Materials and Methods:-

The seashell aggregate waste studied is purged from a roadway in the region of Saint Louis, town located at 250 km from Dakar (Senegal).

The following analyzes were made on this material, based on the standards [5-6]:

- Particle size analysis which deals with the identification for the classification of a material from the size of the grains [7]
- The Atterberg limits, which define the liquid limits and the plasticity limits [8-9]
- The Proctor test which determines the compaction characteristics of a material: water content and density [10]
- The CBR test which describes the test methods for measuring CBR indices [11]

Results and Discussion:-

Particle size analysis of the seashell aggregate showed 3% gravel, 13.83% coarse sand, 56.38% fine sand and approximately 26% silt (Fig. 1).

The Atterberg limit test (Fig. 2) showed that the LL liquid limit is equal to 72.5% and the plasticity index Ip equal to 41.86, thus the material has high plasticity.

The modified Proctor test allowed the determination of the dry density of the banco shell which is equal to 2.05 g/cm3 with an optimum water content equal to 6.00% (Fig. 3).

The CBR test gave a CBR equal to 30 to 95% compactness (Fig. 4).

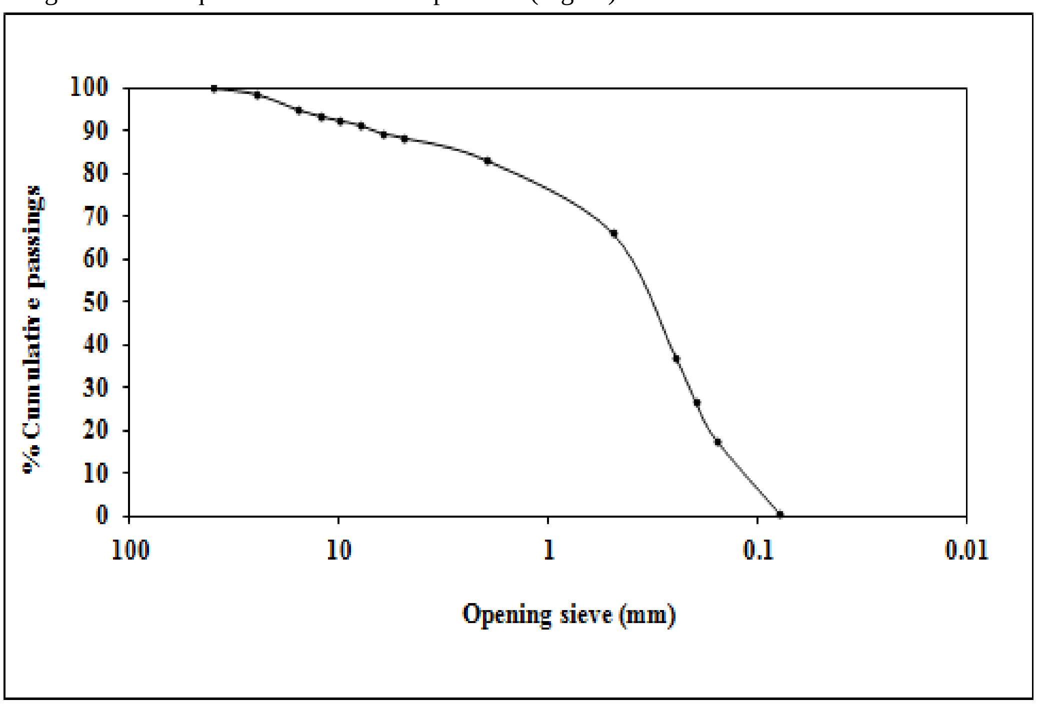
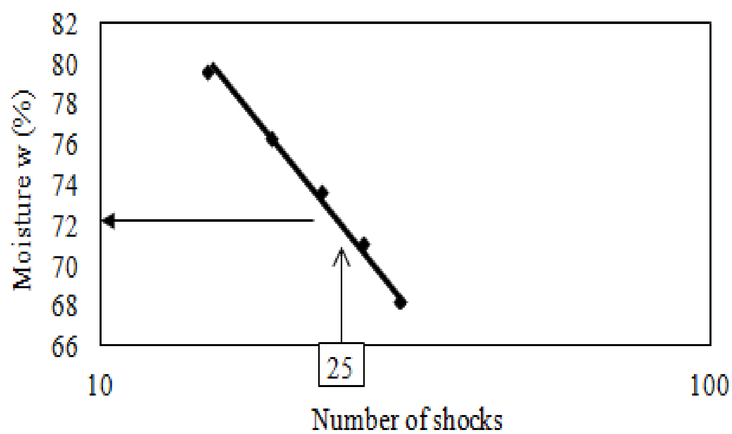


Fig. 1:- Size analysis.

	Limit Liquidity					Limit Plasticity		
Number of shocks	15	19	23	27	31			
No tare	6	25	29	19	32	30	27	10
Total mass wet (g)	8.38	8.39	8.01	7.29	8.77	6.8	6.76	6.58
Total dry mass (g)	5.74	5.8	5.62	5.26	6.18	5.77	5.75	5.59
Mass of the tare (g)	2.43	2.41	2.38	2.41	2.39	2.43	2.42	2.37
Mass of water (g)	2.64	2.59	2.39	2.03	2.59	1.03	1.01	0.99
Net dry mass (g)	3.31	3.39	3.24	2.85	3.79	3.34	3.33	3.22
Moisture w (%)	79.76	76.40	73.77	71.23	68.34	30.84	30.33	30.75



LL = 72.50%

LP = 30.64%

IP = 41.86%

Fig. 2:- Atterberg limits.

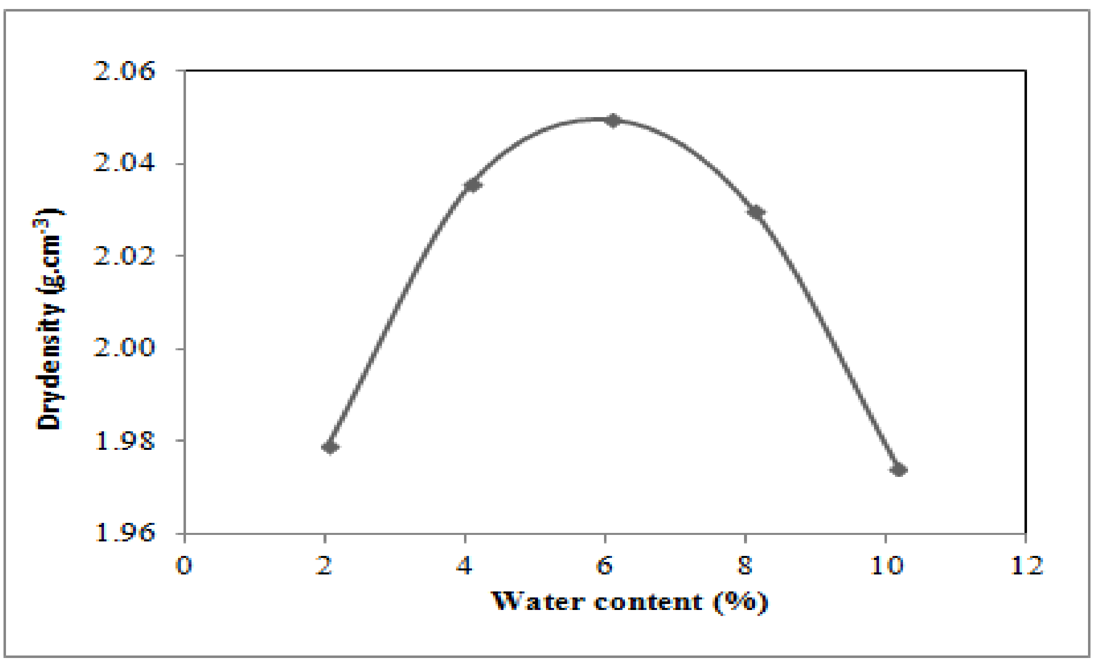


Fig. 3:- Compaction curve Proctor.

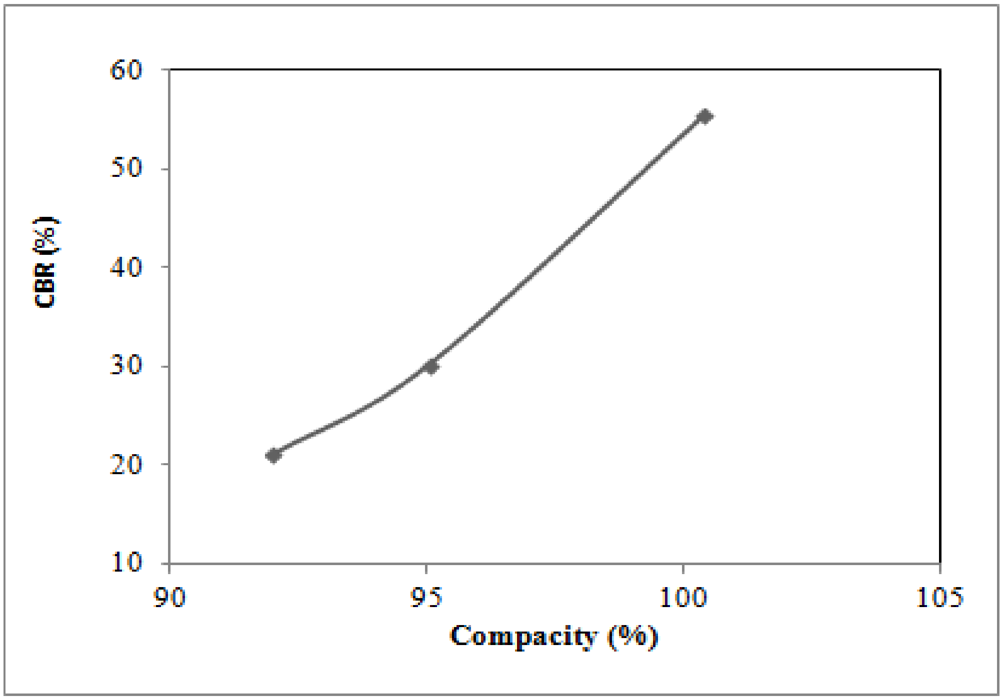


Fig. 4:- CBR of the seashell aggregate wastes.

Thus, this material (banco shell waste) can be used as a capping layer. However, it cannot be used as a base course. To improve the CBR, we treated this material by adding Portland cement [12-13-14].

The treatment of this material with 1.5% cement resulted in a CBR equal to 94 for a compactness equal to 95% (Fig. 6). Also, the treatment of this material with 2.5% cement made it possible to have a CBR equal to 140 for a compactness equal to 95% (Fig. 7). [2]

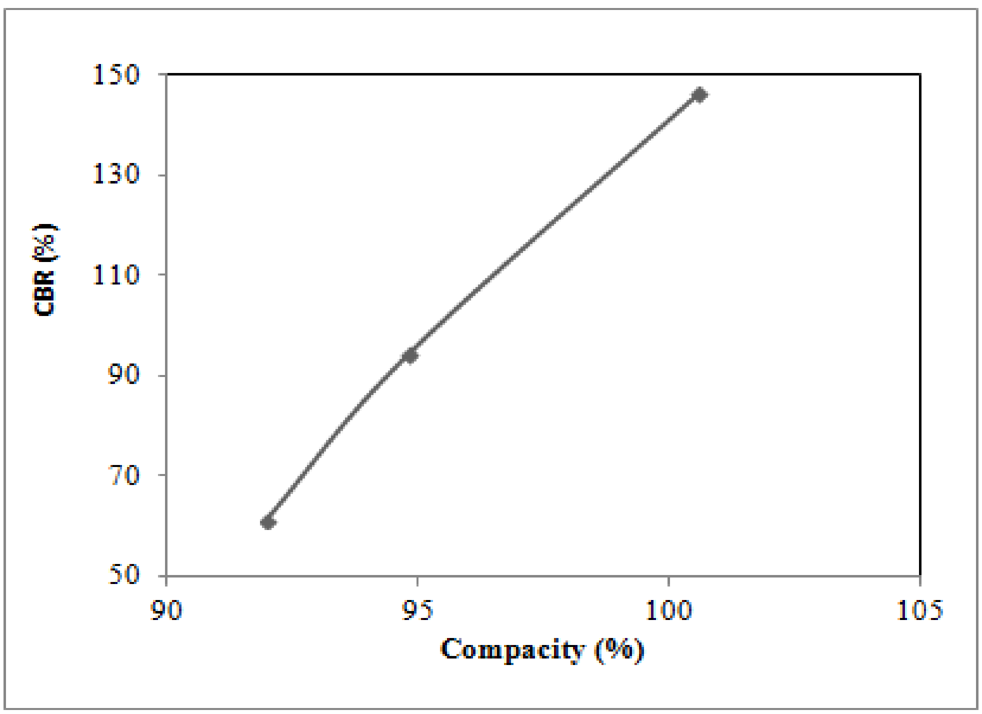


Fig. 5:- CBR of the seashell aggregate wastes mixed with 1.5 % cement.

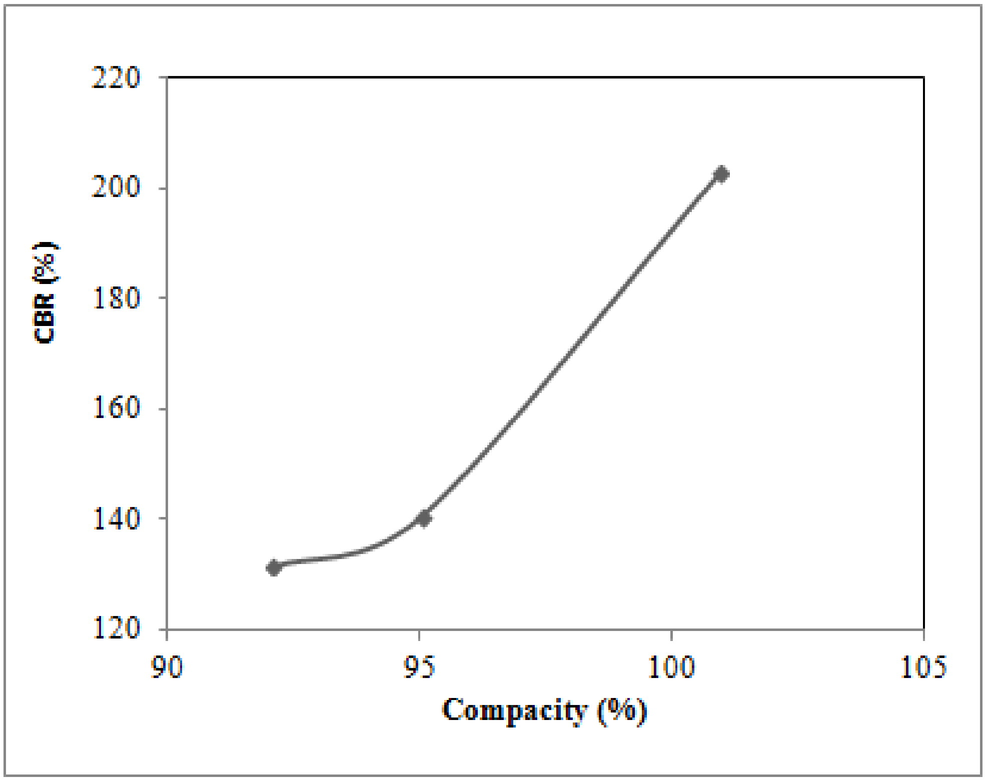


Fig.6:- CBR of the seashell aggregate wastes mixed with 2.5% cement.

Conclusion:-

At the end of our study, we note that:

The treatment of the material (seashell aggregate waste) with 1.5% cement made it possible to have a CBR equal to 94 for a compactness equal to 95%, thus justifying its use as a capping layer.

The treatment of the material with 2.5% cement made it possible to have a CBR equal to 134 for a compactness equal to 95%, thus justifying its use as a foundation layer.

Therefore, treatments with Portland cement made the properties of the material better for its use in pavement layers.

In the final analysis, we can say that, this work makes it possible to recover road waste: the case of the seashell aggregate.

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