Available online at www.sciencedirect.com

ScienceDirect

Energy Procedia 74 (2015) 226 – 233

Energy Procedia

International Conference on Technologies and Materials for Renewable Energy, Environment and Sustainability, TMREES15

Influence of Rubber Fine Powder on the Characteristics of the Bitumens in Algeria

N. Kebaïli[(1)], A. Zerzour[(2)], F. Belabdelouhab[(3)]

[(1)] *Université Ouargla, Faculté des Sciences Appliquées, Laboratoire Exploitation et Valorisation des Ressources Naturelles en Zones Arides, (EVRNZA), Ouargla 30 000 Algeria, kebaili.na@univ-ouargla.dz*

[(2) (3)] *Ecole Nationale Supérieure des Travaux Publics ENSTP, Alger, ALGERIA belabdelouahabf@yahoo.fr*

Abstract

The presented research aims to develop the rubber fine powder in wearing course. It is interested particularly in the behaviour of two types of bitumen 40/50 modified by addition of two varieties of fine powders of rubber of different granularities. In addition to the objective of study and the evaluation of the influence of polymer added on the physical properties of the road bitumens, this work aims at following the influence of the granularity and proportioning in fine powders on the rheological performances of the bitumen by the intermediary of the tests of softening and Ring and of the tests of penetrability to the needle according to various contents. Except the environmental advantage, the tests carried out showed that the addition of fine powders, in a certain interval, has a significant influence on the mechanical properties and rheological of the analyzed bitumen and leads on a whole of interesting correlations.

Peer-review under responsibility of the Euro-Mediterranean Institute for Sustainable Development (EUMISD)

Keywords: bitumen, rubber fine powder, penetrability, softening.

1. Introduction

The bitumen binders in their traditional configuration do not ensure any more one satisfactory behaviour under heavy and channelled traffic and of the durably raised temperatures[1], such as the conditions reigning in the Algerian South, which encourages improving their rheological properties to make them compatible with the climatic conditions and of traffic current.

* *Corresponding author. Tel.: 213 0662120808; fax: 213 029647077.*
E-mail address: kebaili.na@univ-ouargla.dz.

Peer-review under responsibility of the Euro-Mediterranean Institute for Sustainable Development (EUMISD)
doi:10.1016/j.egypro.2015.07.583

The improvement of the characteristics of the road flexible pavements proves to be essential in front of the growth of the traffic and the importance of the increasingly large loads of the vehicles, this improvement developed, amongst other things, by the introduction of new techniques and proceeded of modification of the bitumen binders constituting the wearing course of the road and airport roadways.
Among the solutions aiming at the improvement of the road asphaltic concretes. That presented in this study consists on the modification of the basic bitumen by compatible polymer addition with an aim of improving its physical and mechanical performances.
In the world, important numbers of types of polymers are used in the bituminous mixtures, the present study is interested particularly in the fine powder of rubber coming from worn waste following a mechanical crushing; it is about a plastomer of the type EVA (ethylene and vinyl Acetate) produced locally. This waste at the end of the cycle, thrown in nature, constitutes a threat for nature and the environment because of their obstruction and weak bio-degrability.
The fine powder of rubber, is used like agent modifying built-in, in the basic bitumen, before the operation of malaxation of the bituminous mix according to the hot process (dry process), the goal is to arrive to better performances in term of quality of use and durability.
For this purpose, the objective of this study is to develop the rubber fine powder in the asphaltic concrete of the wearing course where this one is built-in in the basic bitumen, the ultimate goal through this application is to improve the performances of the bitumen, therefore bituminous mix, and to arrive to a new composite "bituminize-rubber" to the rheological and mechanical properties higher.
Thus the rubber fine powder, resulting from the crushing of the rubbery elements, is a process which has the merit to combine the interests of the road to those of the environment and which, economically, should appear very competitive [2].

Historic insight on the modified bitumen

Bitumen Modified with Polymers "BMP" are bitumen binders whose properties were modified by the use of a chemical agent, which, introduced into the basic bitumen, modifies of them the chemical structure and the physical properties and mechanical [3].
In this which follows, one recalls the historical route of the use of rubber in the form of granulated in mixture with the bitumen [4].

- 1840: first experiments of incorporation of the natural rubber to the bitumen in Great Britain [Oul 2005]
- 1938: Bencovitz and Boe published in review "ASTM" an article on the addition of sulphur to the bituminous mixtures.
- 1960: realization, in the United States of America, of the first layers of roadways containing bitumen modified by the rubbers incorporated in the form of latex.
- 1970: significant development of the binders modified in Europe in particular in Germany then in Austria and Italy and appearance of motorway roadways equipped with bituminous surfacing at polyethylene base.
- 1972: first applications of the BMP in France, on a bridge with orthotropic plates.
- 1982: tests carried out jointly between the LCPC of Paris and that of Clermont Ferrand on the valorisation of pneumatic waste in road field.

Currently, bituminize-rubber particularly finds its full application in the road field on the roadways strongly requested such as the surfaces of operations and parking, on the flagstones of the bridges and the inclined roads [5].