

FILLERS USED FOR REALIZING THE ASPHALT MIXTURES IN ROMANIA

ВИДЫ НАПОЛНИТЕЛЕЙ-МИНЕРАЛЬНЫХ ПОРОШКОВ ДЛЯ АСФАЛЬТОВЫХ СМЕСЕЙ, ПРИМЕНЯЕМЫХ В РУМЫНИИ

Drd. eng. Damiean I. M.

Faculty of Construction and Installation, Departament of Railaways, Roads and Bridges, Romania
Technical University "Gh. Asachi"-Iasi, Romania

Abstract: The paper presents the lab results for 5 types of filler used in producing the asphalt mixture in Romania as well as other physical-chemical characteristics of a new type of filler, derivate of the grinding of the bitumous schists through a ball mill/ crusher.

Knowing these physical-chemical characteristics is crucial for asphalt mixtures due to the complex purpose of the filler.

KEYWORDS: FILLER, ASPHALT PAVING MIXTURE, BITUMOUS SCHIST, FILLER SCHIST.

1. Introduction

The filler is defined as a mineral powder consisting of 72% particles with a size under 71 microns obtained by crushing of any natural basic rock (limestone, dolomite, chalk-stone, asphaltic rocks) and also by extinction of lime in the powder. [6]

The special part of the filler in the asphaltic concrete determined a great number of researches dedicated to this element, the filler influencing in a different manner and very complex the properties of the asphaltic mixtures, of the bitumen and also the consolidation condition.

In the composition of concretes and asphalt grout, the filler is a mandatory component which must fulfill certain requisites: [7]

1. It mustn't react chemically with binding agents.
2. It must ensure a good adhesiveness of the binding agent on the filler granule.
3. Its granules shouldn't be porous, in order not to increase the binding agent consumption through absorption.
4. It must not selectively adsorb certain components of the bitumen, which might lead to the incongruous modification of the binding agent's characteristics.
5. It must have an adequate hardness.
6. It must have an adequate gauge.
7. The humidity must be maximum 2%.

In order to realize the asphalt mixtures, in our country there are 3 types of fillers (according to STAS 539-79):[8]

1. Limestone filler;
2. Chalk filler;
3. Powder hydrated lime filler.

Limestone filler is obtained of limestone rocks, with a calcium carbonate content of at least 90%, through their fine grinding and centrifugal processing of the material in order to achieve the necessary granulation.

The chalk filler is obtained through fine grinding of raw chalk.

Powder hydrated lime filler is obtained through the liming of the construction balls with water or stream quantities, followed by the corresponding separation.

In the anglo-saxon countries, [1,2] the filler is defined as being a mineral particle powder that has particles that go through sieves of 200, the interior size of these meshes being of 74 microns in USA and 76 microns in UK.

In the German language countries the filler can be defined as being a mineral powder that is fit for sieves of 90 microns, 76 microns or even 60 microns. [2]

In France, [4,5] the filler used in achieving the asphaltic mixture composition contains particles that are fit for sieves of 80 microns. The conclusion we can draw from all these filler "definitions" is that the difference between the fillers used in Romania and the fillers used in other countries cannot be considered as being an appreciable difference between the filler particles.

In Romania the filler is produced by a number of companies and among these we name: Moldocim Bicaz, Lafarge Romcim, Tempo

Invest Creta Basarabi, Romtextil S.A., Salarom S.A., Mineral Exchim.

In our country the filler is used for the asphalt paving mixtures in a percentage of 5-15% and for the cast asphalt in a percentage of 20-30%.

2. Results and discussion

For the laboratory studies there were sampled 5 filler types from Romania used in executing asphaltic mixtures:

1. Delnita filler, extracted from Delnita,
2. Bicaz filler, extracted from Bicaz,
3. Fieni filler, extracted from Fieni,
4. Basarabi filler, extracted from Basarabi,
5. Tg. Jiu filler, extracted from Tg.Jiu.

For all these filler types there was determined the granulometric curve, wettability coefficient, apparent density and specific area:

Establishing the granularity is absolutely necessary because the gross filler that is added to asphaltic mixtures dose not fulfill its complex role and a much too fine filler leads to increase in the binder usage, and can make more difficult the mixture homogenizing and favors binder ageing acceleration.[7]

The wettability coefficient is defined as being the report between the filler volume after growing in the polar environment (water) and the volume of the same filler quantity after growing in a non-polar environment (oil).

The wettability fillers have a greater affinity towards water than bitumen, being easy separable from the hydro-carbonate binder coating and the hydrofibe fillers will behave much better when in water and will not separate so easy from the binder.

Establishing the apparent density of the fillers was made in accordance to STAS 4606-80 in the Road Station laboratory by the same operator.

The specific surface of the fillers is firstly influenced by the filler particles form and was established in laboratory based on the principle "Blaine Permeabilimeter". [10,11]

The values of the granulometric curves, wettability coefficient, apparent density and values of the specific surface of the fillers studied in laboratory are presented as it follows.

Table no.1 Values of the granulometric curves for the fillers studied in laboratory.

Type off filler	Sifting through the screen and sieve , %			
	0.630	0.200	0.100	0.071
Filler Delnița	100.00	99.17	89.58	79.63
Filler Bicaz	100.00	96.67	78.99	66.31
Filler Fieni	100.00	98.02	85.67	72.15
Filler Tg.Jiu	100.00	98.60	90.48	77.25
FillerBasarabi	100.00	97.29	86.17	77.66

Table no.2 Values of the wettability coefficient and apparent density for the fillers studied in laboratory.

No.	Type off filler	Wettability coefficient	Apparent density g/cm ³
1	Filler Delnița	0.55	2.84
2	Filler Tg.Jiu	0.62	2.58
3	Filler Fieni	0.88	2.64
4	Filer Bicaz	0.75	2.74
5	Filler Basarabi	0.67	2.73

Table no.3. Values of the specific surface for the fillers studied in laboratory.

No.	Type off filler	Specific surface cm ² /g
1	Filler Delnița	3842
2	Filler Tg.Jiu	3586
3	Filler Fieni	4623
4	Filler Bicaz	3711
5	Filler Basarabi	3717

Also in laboratory was studied the hole coefficient in compact state: from Delnița filler-0.28, filler Bicaz-0.27, filler Fieni-0.28, filler Basarabi-0.30 and from the filler Tg. Jiu-0.27.

In our country the bituminous rocks are greatly spread and have a special importance because of their bitumen content and the fact that by crushing it can be obtained filler (the so called schist filler).

To obtain the schist filler was sampled a great quantity of bituminous rock from Vadu Moldovei (Romania) and this was chemic-mineralogical analyzed establishing also its physical-chemical characteristics. [3]

As a result of the chemic-mineralogical analysis of the filler resulted from crushing of the bituminous rocks appeared the following inorganic compounds: SiO₂ (51.67%), CaO (6.80%), CO₂ (9.73%), etc., amounting 90.42% and the difference of 9.82% represents the organic compounds: oils, resins, asphaltites and carbenes.

From a mineralogical point of view the schist filler consists of silicates (34.36%), silica (33.07%), carbonates (18.17%).

For this type of filler were determined also the chemical-physical characteristics that are presented below:

1. Dark grey color;
2. Content of CaCO₃ -20%;
3. Wettability coefficient- 0.90;
4. Hole coefficient in compact state- 0.41;
5. Apparent density g/cm³ - 2.33 g/cm³;
6. Specific surface- cm²/g 5144 cm²/g ;
7. Granulometric curve:

Table no.4. Values of the granulometric curves for the filler schist

Type off filler	Sifting through the screen and sieve , %			
	0.630	0.200	0.100	0.071
Filler schist	100.00	93.54	81.23	70.64



Photo no.1 Filler schist studied in laboratory.

Having a percentage of 9.82% inorganic elements, the obtained filler by crushing the bituminous rocks fulfill the conditions of activated filler and its use is recommended in the respective state.

The filler schist was studied and also in mixtures asphalt, but the results were not conclusive.

“The quality” of this filler was demonstrated by physical – mechanic characteristics determined on test body, made of mixtures with calk filler and mixtures with schist filler, for 2 type and mixtures with schist filler, for 2 type of mixtures: BA8 and BA16.

3. Conclusion

In conclusion, the physical-chemical characteristics of fillers studied in the lab correspond to the STAS 563-79 values, being useful in realizing the bituminous mixtures, as the filler influences in a different and complex manner the properties of asphalt mixtures, of bitumen, as well as their consolidation possibility. [7]

From the comparison of the granulometric curves of the fillers studied in laboratory, the Delnița filler has the highest fineness, followed by the Basarabi filler and the Tg. Jiu filler.

From the comparison of the wettability coefficient studied in laboratory, the Fieni filler has the highest fineness, followed by the Bicaz filler and the Basarabi filler.

From the comparison of the density fillers studied in laboratory, the Basarabi filler has the highest fineness, followed by the Bicaz filler and the Fieni filler.

From the comparison of the specific surface fillers studied in laboratory, the Fieni filler has the highest fineness, followed by the Basarabi filler and the Bicaz filler.

An observation worth to take into consideration concerning the filler production in our country is that the concrete producing companies are generally also producing filler.

All the values were determined by that same technical operator and was remade by [9].

4. References

1. Asphalt Institute Building University of Maryland- Manuel du beton bitumineux, Edition française, Paris, 1956;
2. Bruno, B., Aldo Di Renzo- Pavimentazioni stradali, Editura Ulrico Hoepli Milano, 1959;
3. Cazimir, E., Dumitriu, M., Pasca, V. - Etude chimique des quelques schistes meniliques du flysch des Carpathes Orientales XX, Bucharest;
4. Duriez, M., Arrambide, J. - Les enrobés bitumineux, Tome I, Nouveau traité de matériaux de construction, Paris;
5. Duriez, M., Arrambide, J. - Les enrobés bitumineux, Tome II, Nouveau traité de matériaux de construction, Paris;
6. Gugiuman, Gh.- of the roads, Editorial Techical, Chisinau, 1996;
7. Nicoara, L., Costescu, I.- The building of the roads, Editorial Treffa, Bucharest, 1992;
8. Xxx-SR- 539-79-Filler of limestone, filler of calk and filler of the power calk ;
9. Rumsiski, L., Z., - Mathematic processing of the experimental data, Guide book, Technical Publishing House, Bucharest, 1974;
10. Xxx-SR EN-933-10-2001, - Tests for establishing the aggregates geometric characteristics. 10th Part. Appraisal of fineness. Establishing filler granulation (screening in air stream);
11. Xxx-SR EN 1097-4-1999 – Tests for mechanical and physical characteristics of the aggregates. Part 4: Establishing consolidated dry filler porosity.