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Use of Recycled Polyethylene in Asphalt Mixture

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Abstract

Plastics and plastic products have become part of our lives extremely quickly. Although, they make our lives easier in many aspects, at the end of their useful life, especially thanks to the thoughtless actions of people, they are becoming a serious environmental problem. Even though the laws and legislation are still forcing limits of using the plastic products and thus prevent waste, the concept of plastic-free living is probably not going to be reached easily and quickly. Using the recycling technology, we can prepare the recycled material, which represents a new raw material resource. With the right choice of physical-chemical parameters of recycled materials and using a suitable reaction condition we can incorporate them into the asphalt mixtures. Since their introduction the polymer-modified asphalt mixtures have gained in importance during the second half of the twentieth century, and they now play a fundamental role in the field of road paving. Moreover, the use of recycled plastic in such a product will contribute to the technical and economic recovery of secondary raw materials. The use of various recycled material in paving industry is a common practice but needs further research work. Thus, this study aims to the incorporation of recycled plastics into asphalt mixture. The main objective of our work was to find a suitable recycled plastic, which with its physico-chemical and technical parameters is suitable for incorporation into the asphalt mixture. In our study the recycled low-density polyethylene granulate was used, taken from films and various packaging materials. Our preliminary laboratory experiments were based on the possibilities to prepare and characterized the asphalt mixtures containing recycled plastic at different percentage, i.e., 4 %, 6 %, 8 % and 10 % by weight of bitumen. The experimental tests performed in the study were bitumen content, intergranularity, maximum bulk density, water sensitivity and resistance to permanent deformations. The results showed that the mix containing 6 % by weight of recycled plastic has ideal properties and meets most of the criteria that have been set for asphalt mixes. A commercially available polymer of similar chemical composition to the recycled material was used as a reference sample.

Keywords: low-density polyethylene, recyclate, asphalt mixture, reaction conditions, polymers

1 Introduction

A few decades ago, we could not have imagined that polymers and materials made from them, would become part of our lives that we would have to restrict and regulate their use, neither their production, distribution nor reuse. Can we even imagine our current way of living without plastic products? The answer is that it is certainly very difficult, if not impossible. Plastics are

everywhere around us and have become common in our everyday life. For example, vast amount of food is packed in plastic to preserve its quality for maximum time. Even the textiles we wear are made from man-made fibres, which can fulfil a variety of functional properties. A family of four produces up to 150 kg of plastic waste per year [1]. The average Slovak uses 466 plastic bags a year. Slovaks belong to the most plastic bags users among European Union countries, with up to 89 % of these bags are being used only once. The average annual consumption in the EU is 198 single-use plastic bags, which represents a daily consumption of 1 bag per household [1].

Plastics, or in other words polymers, are macromolecular compounds that can vary greatly from one to another depending on their chemical composition (the basic backbone of most polymers is composed of carbon atoms, hydrogen in possible combination with oxygen, nitrogen, chlorine, or sulphur). Polymers are formed by polymerization from monomers (repeating, interlinked molecules). In their structure, they contain various characteristic groups that are either directly involved in the formation of the polymer chain or are simply bonded to it. In addition, other substances (called additives or fillers) can be added to improve selected properties and polymer becomes a composite material. It is the variability in properties (e.g., heat resistance, hardness or resistance to chemicals) combined with the basic property of plastics, plasticity, uniformity of composition and relatively low weight (in large volume), that allows for use in all industries [2]. The development of plastics can be dated back to the time when natural polymeric materials such as natural rubber in the form of chewing gum or various tree resins in the form of adhesives were firstly used. This was followed using chemically modified natural materials and it is continued today with the production of synthetic macromolecules produced by a variety of specific technologies.

Almost 90 % of produced plastics is thrown away immediately or within a few days (bags, packaging materials, bottles, wrappers, lighters, etc.). This leads to the global plastic/garbage problem. Hence, the following two main facts can be considered when we used the polymers:

- Plastics are mainly made from petroleum, which is a renewable natural resource.
- Plastics can only be recycled to a limited extent, but in nature plastics are almost indestructible - they are lightweight, durable, flexible and can withstand water, sunlight (and UV rays if they contain additives) and mechanical damage.

Recycling of the plastics is of high importance. To recycle plastics, one sorts them in recycling companies on sorting lines - the waste components that do not belong in the sorted plastics or are contaminated are sorted out. The sorting into different types depends on the processor or processing method. Sorted plastics are prepared for further processing [3].

Plastics are milled into various crumb stones or small pellets, which are used by melting and extrusion in the production of new products - they are treated as secondary raw material in the form of agglomerates or granulates for a specific product. Such recyclates are given a second chance and are reusable in a variety of industrial applications.

One possible use of such recycled plastics is for incorporation into asphalt mixes. On the other, it should be pointed out that not every plastic is suitable for such applications. Based on late research such granulates made from low-density polyethylene (LDPE) can be used very efficiently as an additive in asphalt mixtures.

At the very beginning we need to understand what such a multicomponent system consists of and by what possible force they are connected.

Basically, the asphalt mixture is a mixture of aggregates, binder, and fillers, used for constructing and maintaining roads, parking areas, ports, airport runways, bicycle lanes,

sidewalks and also playgrounds and sport areas. It is produced in a plant that heats, dries, and mixes initial materials (aggregate, sand and bitumen) into a composite mixture. It should be pointed out, that the term asphalt is often mistakenly used to describe bitumen. According to the European specification (EN 12597), bitumen is a practically non-volatile, adhesive, and waterproof material obtained from petroleum or present in natural asphalt, which is completely or almost completely soluble in toluene and it is very viscous, or almost solid at ambient temperature [4]. Elemental analysis shows that the properties of the bitumen binder are primarily determined depending on the source of oil, properties of crude oil and distillation refining process, respectively. From a chemical point of view, bitumen is a complex mixture of approximately 300 to 2000 chemical compounds. The most and important are two groups of species: asphaltenes and maltenes [5].

Asphaltenes are amorphous brown, and/or black solids which contain oxygen, sulfur and transition metal atoms in the form of porphyrin rings of different length of aliphatic chains, pyrrole and pyridine rings. These large aromatic systems form large agglomerates / aggregates that are connected by intermolecular forces and π - π interactions. The resulting molecular aggregates form the so-called sandwich clusters and cause lower mobility of asphaltene molecules and thus significantly affect the viscoelastic properties and especially flexibility of bitumen. The proportion of asphaltenes in the bitumen ranges from 5 % to 25 % [6]. Due to the permanent electric charge and the presence of polar groups, together with polycyclic aromatic rings and metal complexes, asphaltenes contribute to the surface activity and adhesion of bitumen to aggregates.

Maltenes, which are responsible for adhesive properties, flexibility, and stiffness, form the second important fraction of bitumen structure. They contain lower molecular weight compounds, including resins, aromatic oils, saturated paraffins, respectively. Maltenes are soluble in low molecular n-alkane (n-pentane, n-heptane) [7].

Due to the good physico-chemical, rheological and thermal properties the net bitumen can be mixed with a wide range of chemical entities. According to their action the modifiers can be divided into adhesion, plasticizing, structuring and complex ones. A common feature of all such additives is that they must be compatible with the asphalt and can in no way impair the properties of the resulting mixtures.

Scientific research into the incorporation of various additives into asphalt has been growing steadily in recent decades and there are a number of materials that have been investigated.

They have been investigated for example nanomaterials [8], crushed rock, masonry and concrete [9, 10], bio-mass based product, such as bio-char, bio-oil, and bio-ash, etc. [11]

However, the most studied and already used in technical applications are plastics/polymers [12 – 17]. Regarding the use of plastic wastes for bitumen modification, those mentioned in the literature review are the low-density polyethylene [18], high density polyethylene [19], polypropylene [20] ethylene-vinyl acetate (EVA) [21, 22], acrylonitrile-butadiene-styrene [23], polyethylene terephthalate [24]. The recycled rubber from truck tires has also found great applications [25 – 28].

As it was demonstrated above many types of polymers are typically used in bitumen modification in different forms such as plastics, elastomers and reclaimed rubbers. On the other there are several limitations that must be fulfilled to prepare a good asphalt mixture with polymers. The produced polymer-modified asphalt mixture (PMAs)should satisfy a long list of requirements including appropriate mechanical properties, storage stability, high-temperature viscosity compatible with the traditional road-building processes and apparatus, and reasonable

cost, which remains of primary importance [13]. Given all these limitations only a very small number of polymers are currently used in industrial applications. A special criterion - especially in industrial applications in Slovakia - that such an application should be suitable for current asphalt mix plants in Slovakia. For above mentioned reason over research is oriented to the preparation of asphalt mixture with recycled polymer by so-called dry process. The dry process allows coating of plastics to the aggregates at high temperature followed by addition of bitumen to prepare the modified mix. The process seems to be very simple. On the other hand, the right chose of plastics – especially in case of recycled plastics – and the right chose of the reaction condition are of very high importance.
For that reason, the main objective of the presented research work was to demonstrate under laboratory conditions the effective use of recycled waste plastic by incorporating it into asphalt mixtures. Of course, to achieve our goal we had to fulfill some basic sub-objectives. One of the main criteria was to find a natural "one-component" polymer which should have a good miscibility in bitumen (blank sample). After this step we needed to find a suitable "recycled copy" of this material, which will have a very similar physical-chemical properties. The most common problem when a recycled plastic is used is the physical-chemical properties may differ from those of commercial, natural/virgin polymers. These quality differences add even more variables to the overall process mechanism and can have a major impact on the use of recycled plastic, the process technology, and the quality of the resulting asphalt mixture. The reaction conditions, such as the amount of plastic, temperature, mixing time, had to be set so that the mixture was completely mixed to completely coat the aggregate. The quantity and chemical nature of the recycled plastic must be very sensitively adjusted so that the recycled plastic is not completely dissolved during mixing and the quantity is such that the rheological properties are not ultimately compromised. If this were to happen the resulting properties would not meet the criteria for conventional asphalt mixture. The presented research work describes a very efficient way of incorporating recycled plastic into the asphalt mix.

2 Experimental Section

2.1 Materials and its Basic Characterization Methods

The bitumen with a penetration grade 50/70 from the Mol Hungarian Oil and Gas, Hungary has been procured and used (abbr. CA 50/70). This is the most used asphalt binder and meets the criteria for this type of research. All basic parameters of the bitumen were measured to make sure that the bitumen was of satisfactory quality for mix design. The measured parameters were penetration (according to EN 1426), softening point (according to EN 1427) and kinematic viscosity at 135 °C (according to EN 12 595), respectively. To assess the internal microstructure of the asphalt binder, a microscopic method using a scanning electron microscope (SEM, Tabletop Scanning Electron Microscope TM4000Plus (Hitachi High-Tech Corp., Japan) and an energy dispersive X-ray spectrometer (EDX) attached to SEM, AZtecOne (Hitachi High-Tech Corp., Japan) were used.
Aggregate from the Horný Tisovník deposit was used. The aggregate meets the requirements of the departmental regulation [29].
A commercially available low-density polyethylene (abbr. as LDPE) from SLOVNAFT, a. s. Slovakia was obtained.

Waste recycled plastics - the so-called low-density polyethylene recyclate - was obtained from RE-PLAST, s r. o., Zvončín (abbr. in the text LDPEre).
In case of LDPE and LDPEre sample the basic thermal and viscosity parameters were analyzed according to the required test methods used for the characterization of polymers.

2.2 Methods

In the actual design of the asphalt mixtures, the requirements of the departmental regulations KLAZ (Catalogue sheets for asphalt mixtures) [30] and TKP 6 (Technical-qualitative conditions for compacted asphalt mixtures) [31] were respected.

2.3 Laboratory Preparation of Asphalt Mixtures and Evaluation of Measured Results

A total of 3 asphalt mixes were prepared and characterized in this work, namely:

- Asphalt mixture: AC 16 loading 50/70 (designation in the text AC 16 L)
- Asphalt mixture: AC 16 loading 50/70 with 6 wt. % LDPE (designation in text AC 16 L-LDPE)
- Asphalt mixture: AC 16 loading 50/70 with 6 % by weight recycled plastics (designation in text AC 16 L -LDPEre)

For the procedure and conditions to produce the asphalt mixture in the laboratory the conditions in EN 12697-35 were used. The asphalt mixture shall be prepared at the required temperature, within the prescribed time interval. This required temperature being dependent on the gradation of the asphalt binder and related to the temperature of the subsequent compaction of the asphalt mixture during the production of the samples. A laboratory mixer equipped with thermostatically controlled heating and mechanically controlled speed was used to produce the asphalt mixtures. The mixer used to have a beater agitator, which is necessary to ensure that no damage to the aggregate or the mixer vessel can occur during mixing.
The aggregate (set of fractions according to Table 3) was dried to a steady weight in a ventilated drying oven at (110 ± 5 °C) prior to mixing with the desired grading lines along with the stone flour. Subsequently, the aggregate together with the stone fluor was weighed to an accuracy of 0.1 %. The net bitumen was also heated in a metal container (150 ± 20 °C) during preparation. After heating the initial samples, we proceeded to mix the asphalt mixture. Before mixing, we heated the container to the desired temperature and poured the weighed fractions of aggregate with stone flour into the mixing container. The aggregate grains were premixed for thorough mixing. After weighing the hot binder, we added the binder to the aggregate. The ingredients were thoroughly mixed, continuing mixing until a homogeneous mixture was obtained, and the aggregate was completely coated with the binder. The homogeneity of the mixture was checked visually. Mixing was stopped after four minutes. In case of the preparation of the asphalt mixture with added LDPEre, we followed a similar procedure, whereby the recyclate was added on top of the aggregate and after thorough mixing we added the hot bitumen. However, it should be noted that in this case, after visual inspection, we proceeded to increase the mixing time up to 5-6 minutes. After this time, we obtained a homogeneous asphalt mixture without any incompletely homogenized recycled granulates. It is important to remember that the added polymer - regardless of whether it is recycled or commercial ones – the equal amount of binder is replaced. This is very important due to the comparability of mixtures. We tried to keep the content of the components.

All empirical parameters of asphalt according to the respective catalogue sheets were analyzed in labrotory.

3 Results and Discussion

3.1 Basic Characteristics of Used Bitumen

At the beginning of the experimental work, we focused on the basic characterization of the initial samples. Table 1 shows the basic parameters of the bitumen sample CA 50/70 (STN EN 12591).

Table 1: Composition of the envelope structures of the assessed room

Tested characteristics	**Measured value**	**Test method**	**Requirement KLAZ**
Penetration at 25 °C; 0.1 mm	54.5	STN EN 1426	50 – 70
Softening point KG; [°C]	50.6	STN EN 1427	46 – 54
Kinematic viscosity at 135 °C; [mm^2/s]	539.1	STN EN 12595	≥ 295

The measured values clearly show that the bitumen sample CA 50/70 meets all the requirements for bitumen, used as a binder of the production of this type of asphalt mixture according to the asphalt catalogue sheets.

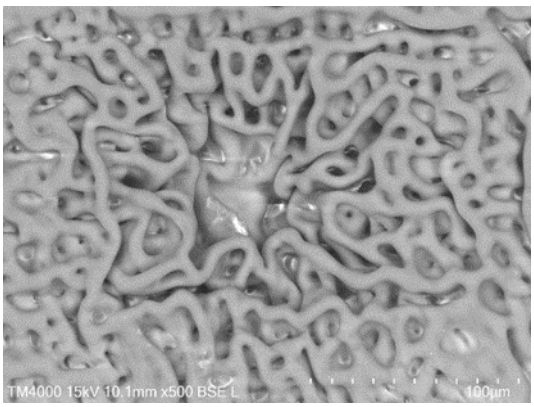


Figure 1: SEM micrograph of used bitumen sample CA 50/70

The SEM micrographs refers to the standard inner structure of bitumen (Figure 1). The structure was homogeneous, and no impurities in the binder have been identified. Elemental chemical analysis showed that used bitumen contains more than 97 % carbon atoms and approximately 2 – 3 % of sulphur atoms (as indicated on Figure 2).

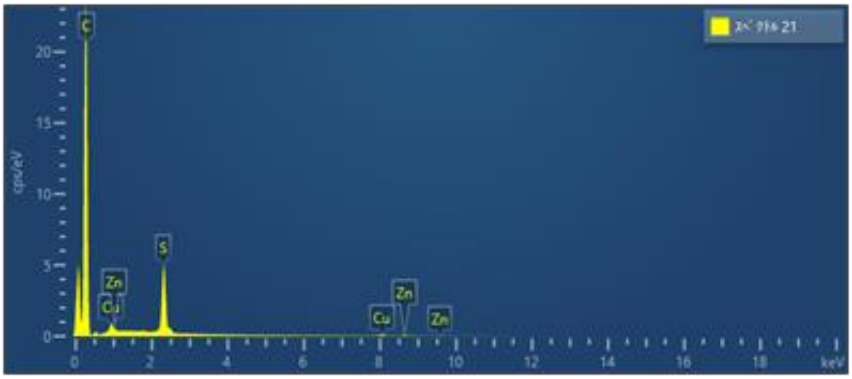


Figure 2: The EDX analysis of used bitumen sample CA 50/70

3.2 Basic Characteristics of the LDPEre

We received the material from RE-PLAST, Ltd. in two plastic 25 kg bags (LDPEre (1.bag) and LDPEre (2.bag). To guarantee the conformity of the two delivered samples, thermal and rheological tests (not shown here) were carried out on samples taken from both bags. Thermal analysis of the supplied recyclate confirmed the assumption that it contains other types of polyethylene (most likely a mixture of PE-LD and PE-HD in the presence of a slip agent, based on present peaks of melting temperatures). However, the composition of the recyclate does not negatively affect its use as an asphalt mixture modifier. Rheological curves can be observed in Figure 3.
Table 2 shows the basic thermal parameters together with the method used for the two LDPEre samples. As a reference sample the commercially available LDPE was used. The sample was tested using the same methods as recyclate samples.

Table 2: Basic thermal parameters of LDPEre (1.bag and 2.bag) and commercial LDPE sample

Property			**LDPEre**	**LDPEre**	**LDPE**
Parameter	**Unit**	**Test method**	1. bag	2. bag	
Melt mass flow rate (90 °C/2.16 kg)	g/10 min	STN EN ISO 1133-1	0.76	0.78	1.95
Melting point	°C		108.8/123.7	108.4/123.3	110.6
Crystallisation temperature	°C	STN EN ISO11357-3	111.7/97.8/ 61.9	111.5/97.8/ 61.9	95.6
5 % weight loss	°C		409.9	410.5	417.8
10 % weight loss	°C	PP SIV 0216	426.5	426.1	435.1
Temperature of decomposition	°C		447.4	445.9	452.9
Ash content	% (m/m)	PP SIV 0202	1.66	1.85	-

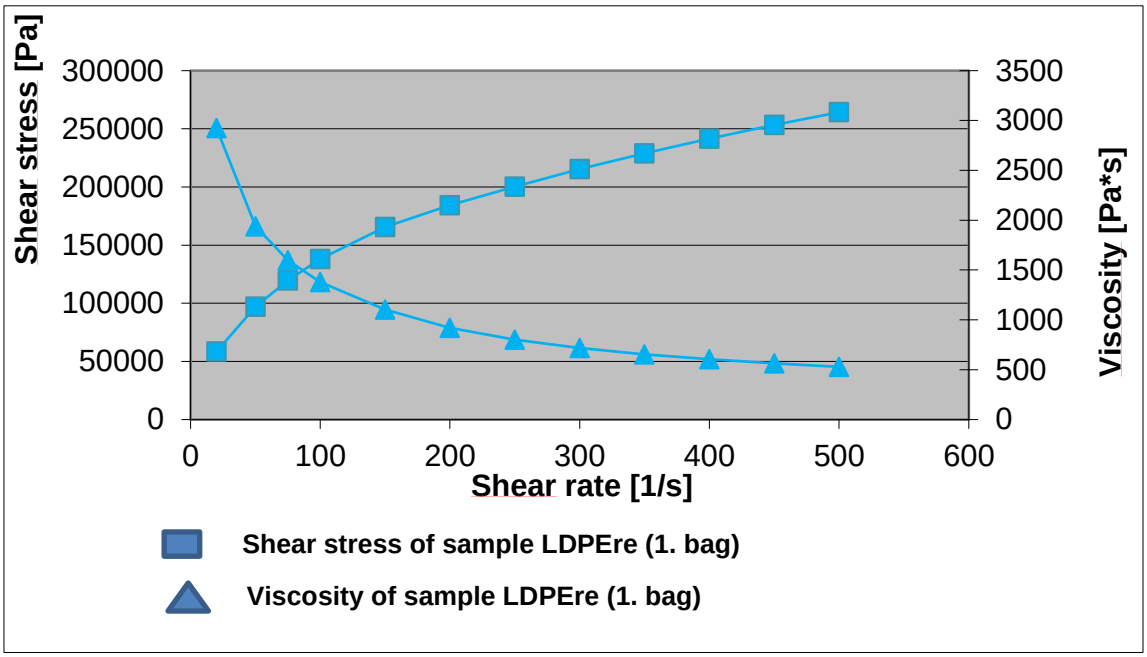


Figure 3: Rheological curves of used LDPEre (1.bag)

Design of the basic composition of asphalt mixtures for asphalt overlays and processing of mix recipes in accordance with the requirements of KLAZ and TKP 6.

In the next part of our study, we proceeded to design the basic composition of asphalt mixtures for the base course AC 16 L. The requirements of the departmental regulations KLAZ (Catalogue sheets for asphalt mixtures) and TKP 6 (Technical-qualitative conditions for compacted asphalt mixtures) were respected in the design mixture. The composition is described in Table 3.

Table 3: Composition of asphalt mixtures AC 16 L

Aggregate	**Fraction**	**% (by mass in AC 16 L mixture)**
Mýtna	0/4	35.00
Horný Tisovník	4/8	22.00
Horný Tisovník	8/11	10.00
Horný Tisovník	11/16	30.00
Žirany	stone flour	3.00
TOTAL		100.00

In case of use of LDPEre, the 6 % LDPEre per weight of bitumen content was used. The percentage recyclate in asphalt mixture was calculated by our previous experiments and based on most common literature evidence [10, 13 – 24 and references therein]. At the very beginning of our research, we start to understand how the polymer is incorporated to the asphalt mixture. We have investigated the various loadings of LDPE to asphalt mixture, i.e., i.e. 4 %, 6 %, 8 % and 10 % by weight of bitumen. The results of tour test showed that the mix containing 6 % by weight of recycled plastic has ideal properties and meets most of the criteria that have been set for asphalt mixes.

The aggregate mixture as shown in Table 3 is composed of individual fractions and stone flour so that the resulting grain size line conforms to the grain size limit lines specified in the respective asphalt mix catalogue list. The resulting cumulative percent passing through the sieve meet the requirements for aggregate gradation and quality according to the applicable technical notes. After successful preparation of the asphalt mixtures at laboratory conditions the set of empirical parameters were investigated. The results are listed in Table 4.

Table 4: The tested empirical parameters of asphalt mixtures

Measured Parameter	**Unit**	**AC 16 L**	**AC 16 L - LDPE**	**AC 16 L - LDPEre**	**Requirements [30]**
Grain size	22.4	100	100	100	100
	16	100	100	98	90 - 100
	8	69	60	52	50 -75
	2	32	27	25	20 - 45
	0,5	15	13	12	7 - 26
	0,063	9.0	8.2	7.4	3 - 11
Bitumen content	B_{min}	4.2	4.2	4.0	4.4
Intergranularity	V	5.0	5.9	6.2	3.5 – 6.0
Maximum bulk density	ρ_{vm}	2.532	2.509	2.512	-
Bulk density	ρ_{bssd}	2.406	2.361	2.356	-
Water sensitivity	ITSR	96	98	95	70
Resistance to permanent deformations	PRD_{AIR}	5	3.4	3.1	3
	WTS_{AIR}	0.048	0.032	0.025	0.07

According to the measured results, it can be pointed out that the laboratory prepared and investigated asphalt mixtures shows very similar properties. Small deviations were measured in the case of intergranularity, resistance to permanent deformations. The small deviation was also confirmed in bitumen content. This can be explained in a simple way. Although in the experiment we follow the so-called wet process, we still try to add individual components to the mixing container by pouring granules on the hot bitumen. This means that the recylate immediately meets the hot bitumen and undergoes chemical decomposition, which is then further aided by the mixing and mixing time. Ideal modification is obtained when the polymer conserves its internal structure after mixing with bitumen, the molecules of which determine only a macroscopic swelling of the network. If the network becomes a continuum that involves

the entire material, the overall mechanical properties of the polymer-modified mixture markedly reflect those of the polymer [13]. Whether this can be realized or not depends on the interactions among the asphalt components and the polymer. Such interactions obviously depend on the chemical affinity of the inner structure, which is characterized by different polarities. Therefore, it seems to be that during the first contact usually the selectively swelling occurred. For our opinion the part of the polymer – the melted small fragments – become the part of the bitumen and thus increasing the volume of asphalt.
The conclusion of this reflection is that the success of the preparation of polymer-modified asphalt mixture comes from the ability of some compatible polymers to significantly influence and improve the rheological properties of bitumen, even when added in relatively small quantities. But, on the other hand the number of chemical entities that are dissolved during mixing and the temperature cannot exceed so much that the rheological properties are ultimately impaired. The other entities are swollen between the aggregates but being fully compatible they do not cause a change in properties.
It should be also noted that he preparation of asphalt mixtures with plastic recyclate - but also with any other type of modifier - can be carried out in two ways. According to the literature and also to practical results, the most ideal solution is the pre-modification of the asphalt binder [32]. As it was mentioned before his method is called the "wet route", where the modifier or, additives (plastic, rubber, etc.) are mixed under given reaction conditions (temperature, pressure, mixing time) to the asphalt binder. This can be done in additional equipment, called mixers or "blenders". The problem is that such equipment does not exist in Slovakia. This means that we have tried to adapt fully to the requirements of the practice. Because of this, our research and subsequent validation has been set up so that the technological procedure could be applicable to current asphalt mix plants in Slovakia.
However, even when modifying the mix itself, both the asphalt and the asphalt with the modifier (in our case LDPE and LDPEre) must meet the adhesion criteria of EN 12697-11. In our research, this is a very important criterion because the LDPEre is used the first time. This type of recyclates for such purposes have been investigated in Slovakia first time. Therefore, we have already carried out affinity tests in the laboratory prior to the actual preparation. We repeated the test with net bitumen type: CA 50/70 and with bitumen CA 50/70 modified with commercially available LDPE. The results were approximately 70 – 80 % for the conventional asphalt, very similar for the adhesion between aggregate with asphalt binder modified with commercially available LDPE, but results were as high as 90 – 95 % when LDPEre was used. This test was decisive for us and confirmed that the recyclate was suitable for its intended use [32]. To illustrate, in Figure 4 are the photographs of the measured results.
The measured values clearly show that the bitumen sample CA 50/70 meets all the requirements for bitumen, used as a binder of the production of this type of asphalt mixture according to the asphalt catalogue sheets.

Even so, we consider these results very promising and by a small change of the reaction conditions we will be able to adjust the whole reaction mechanism in the future to respect the values given in the KLAZ. It should be noted that in the case of using recycled polymer, we must consider many factors that may affect the sample, and these may be since we need to know exactly the source of the waste plastic, the separation of the different components and of course the resulting properties of the recyclate.



Figure 4: Affinity tests between aggregate and net bitumen type CA 50/70 (left), net bitumen type CA 50/70 modified with commercially available LDPE (centre) and net bitumen type CA 50/70 modified with LDPEre (right)

Even if the basic rheological and thermal properties of the sample did not show large variations, obviously even a small change in the physical-chemical properties can cause variations in the final mixture. In further experiments, we must also adjust the entire reaction time and mixing procedure so that the sample is indeed completely homogeneously mixed.

4 Conclusion

The use of recycled low-density polyethylene in asphalt mixtures was demonstrated in this study. Based on our laboratory experiments and results modified asphalt mixture with 6 weights % of recycled LDPE added exhibits properties very similar to conventional asphalt mixtures. From the measured results, it can be pointed out that the asphalt mixture with PE-LD shows very similar properties to that without recyclates. Small deviations were measured in the case of intergranularity which has in overall no effect on the final mixture. Moreover, the mixing time needs to be extended in case of use of recycled LDPE. On the other hand we can conclude that the mixture with recyclate showed a very similar feature as a conventional asphalt mixture. All results and observations must be considered in the production of asphalt mixtures in a plant in a future. The results to date will serve as a basis to produce asphalte mixture in a plant.
However, it is important to be aware of some important facts arising from such multidisciplinary research. The use and therefore the production of plastic products is still increasing all around the world. This is happening even though humanity is still trying to do its best to prevent plastic waste. However, to understand the whole value of the input of plastics to the environment we must consider not only the production/ distribution but also the waste management chain. This is very important feature, because this is the starting line to implement the effective ways and technological procedures for reduction the waste or for its recycling. Incorporation of waste plastic in this scale, as it is described in our study, will not solve the global environmental problem with the accumulation of the garbage. On the other hand, it opens the way to reduce of the environmental impact of reducing the plastic waste. Our effort in this research-oriented paper was to show that how many factors must be taken into consideration to obtain the asphalt mixture that meets all the requirements placed on it. However, by gradually removing all the undesirable properties and by setting up the right mechanism, it will be possible to set up the technological procedures so clearly that the technology of adding waste plastics to asphalt mixtures can be used in common practice in Slovakia soon.

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