Design of the Vibration Separatory Apparatus

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Abstract Stabilization/solidification is used for liquid waste processing. For the purpose of liquid and solid phase separation the experimental vibration separatory apparatus is designed. It can be used with common cement mixer and easily transported by means of the car trailer. The device is equipped with vibration motor and it is designed as hand-operated.

Keywords Designing • Pasty material • Liquid waste • Vibration • Separation • Stabilization • Solidification

1 Introduction

Liquid waste is processed by means of stabilization/solidification. The waste is mixed with binders e.g. in mixing drum and homogenized batch is then exposed to the vibrations. Due to this process the separation of excess liquid from paste of hydrating binders is performed. Treated material doesn't release liquid phase no longer. Collected excess liquid is returned to the process of stabilization/solidification.

The aim is to design the experimental device for separation of liquid and solid phase out of the pasty material of density 1.5–2.5 kg.dm^{-3}. This device should be mobile, it means that it can be transported by car with common carriage. The assembly consists of mixing and the separatory apparatus. One batch of pasty material should be approximately 25 kg.

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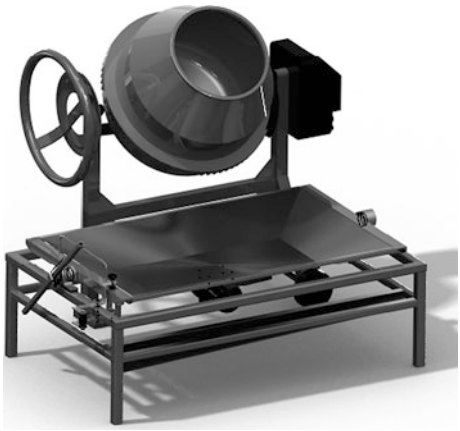

Fig. 1 The assembly of cement mixer and separation apparatus

Table 1 Parameters of vibration motor [1]

Frequency [Hz]	Revolutions [rpm]	Moment [kg.mm]	Centrifugal force [N]	Power [W]	Weight [kg]
50	3000	22	2200	120	6

2 Apparatus Design

The separatory apparatus is designed as tipping pan which is elastically imbedded into welded frame. Tipping pan is welded from stainless steel sheet because of corrosive properties of the pasty material. Due to the economical aspect common cement mixer will be used for mixing operation and that's why the separatory apparatus is designed with respect to the possibility of assemblage of both devices (Fig. 1).

For the efficient separation of liquid phase the vibration motor with elliptical oscillation is used. With respect to the weight of designed construction and the weight of the batch the corresponding power of the vibration motor is chosen. Parameters of chosen vibration motor are shown in the following table (Table 1). The vibration motor is connected to the stiffening frame of the pan.

The pan is imbedded into welded frame of separatory apparatus by means of pin and spring housing which is moreover bolted over rubber plate. At the end of one pin there is put on the operational arm for tipping of the pan. For the fixation of the pan in horizontal position the special turning holder is designed. This holder is equipped by buffer rubber springs to reduce the transmission of the vibration to the base frame. Above described parts of the separatory apparatus are shown in Fig. 2.

Fig. 2 The vibration separatory apparatus – 3D model

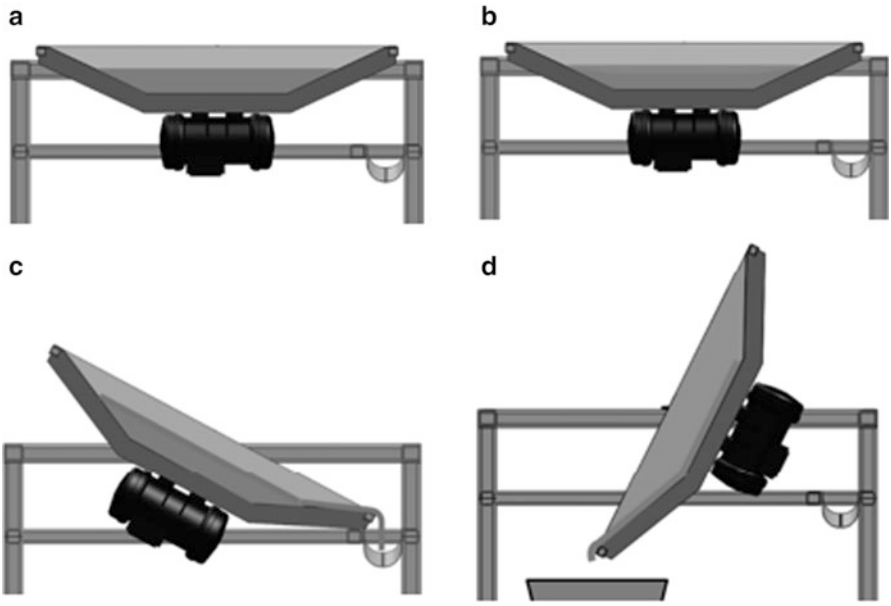

Fig. 3 The cycle of operation of separatory apparatus

3 Cycle of Operation

The cycle of operation of the separatory apparatus will be described in this chapter and it is shown in Fig. 3. Before filling the pan by batch, it has to be fixed in horizontal plane by means of turning holder.

Next the pasty material is poured from the mixer to the pan (Fig. 3a) and the vibration motor is turned on. During the vibration process the liquid is separated above the paste (Fig. 3b). The pan can be tipped to one side and the excess liquid is strained into outlet gutter (Fig. 3c). In last phase the pan is tipped to the second side and the paste without excess liquid is moved out of the pan (Fig. 3d).

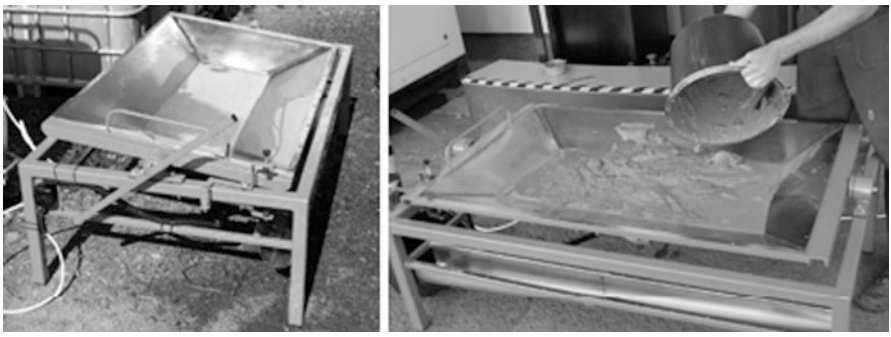

Fig. 4 The vibration separatory apparatus – manufactured device

4 Realization and Results

The experimental device for the separation of liquid and solid phase out of the pasty material was manufactured according to above shown design (Fig. 4). Nowadays the practical tests with different pasty materials are carried out.

References

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