A method of real time quantitative supply of cosmetic raw materials using weight sensor

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Abstract

In this paper, we have discussed a method of real time quantitative supply of cosmetic raw materials using weight sensor. In addition, the technical characteristics of the system were clarified and introduced to the production process, contributing to the automation of cosmetic compounding process.

We have tested the measuring and supply about 6 liquid materials (water, glycerin, propylene, milistynic acid, squalene, liquid paraffin) with this device. According to the measuring results, we have verified supply error is below 0.5% on the average.

Keywords: weight sensor, cosmetic, viscosity, quantitative supply

1. Introduction

In the cosmetics production process, proper mixing of raw materials is one of the most important factors for securing the quality of cosmetics.

In general, a cosmetic (eg, a cream) contains various kinds of materials and their physico-chemical properties are different. Especially, the viscosity and density of raw materials are affected by temperature.[1-3]

Previously, the amount of cosmetic raw materials had been indirectly measured by flow rate measurement in an automated cosmetic compounding process. For a example, proving that liquid determination manners by flowmeter, ultrasonic and pressure sensor using for feed and measurement of liquid material are not adapted for the partial production processes.[4-8]

The approximate masses of raw materials using in producing 500kg batch are given in Table 1.

Table 1. The approximate masses of raw materials using in producing 500kg

raw materials	Mixing ratio(%)	Masses in producing 500kg (kg)
water	35	175
propylene glycol	10	50
glycerin	5	25
stearic acid	7	35
flow paraffin	4	20
squalane	3	15

neugene	1	5
megilp1	1	5
megilp2	1.5	7.5
megilp3	0.5	2.5

In general, the mass of a material is the inherent amount of the material itself which is not influenced by the outside, and therefore it is most accurate to measure and mix the amount of the cosmetic raw material by the mass measurement method.

From this point of view, we propose a method of automatic quantitative feeding of raw materials using mass sensor in the cosmetic compounding process, and based on this, we constructed a weighing supply system.

2. The construction of the device

The system consists of the measure converter, the computer controller, the weighing tub including the electronic valves, the supply channel of raw materials, and so on.

The block diagram of the system is given in Figure 1.

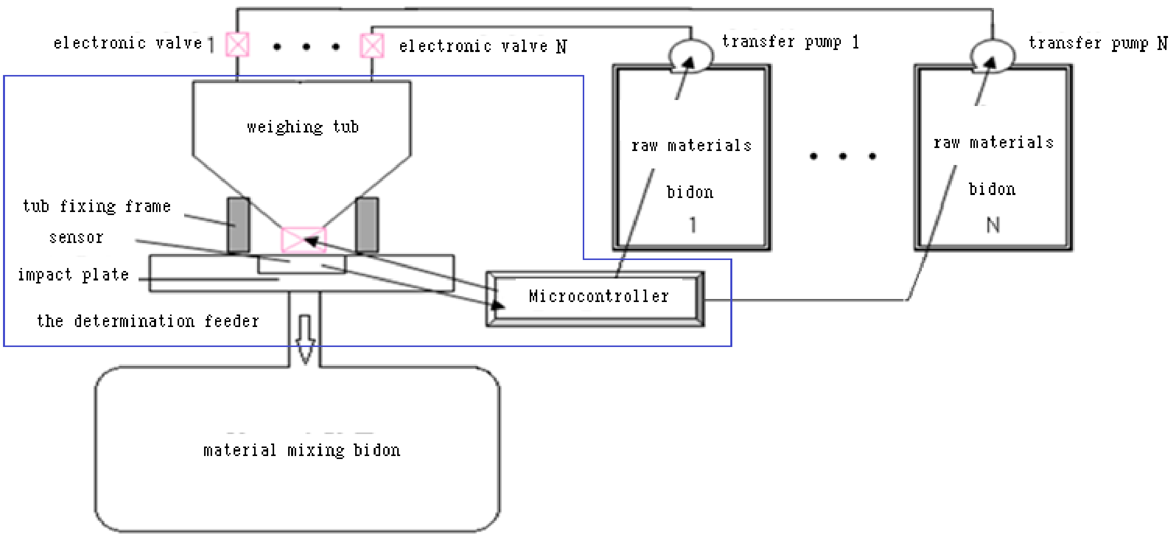

Figure 1. Block diagram of the system

Setting up the supply amount and then clicking start button, liquid material comes into the weighing tub from raw materials bidon.

The amount of liquid coming into the weighing tub settled on the spring balance is measured and displayed real-timely.

If the supply amount set point is above 17kg, the weighing and supply of it are proceeded several times.

Once maximum supply amount set point and the total number of supply are as follows.

The number of supply = [the total set point / 17] + 1 (1)

Once supply amount set point = the total set point/ the number of supply (2)

Operating the transfer pump and raw materials weight of the weighing tub reaching the once supply amount set point, we stop the transfer pump and open the electronic valves and turn out liquid material.

The device consists of the measure converter digitizing the signals from the weight sensor, the computer controller, the display, the data communication system.

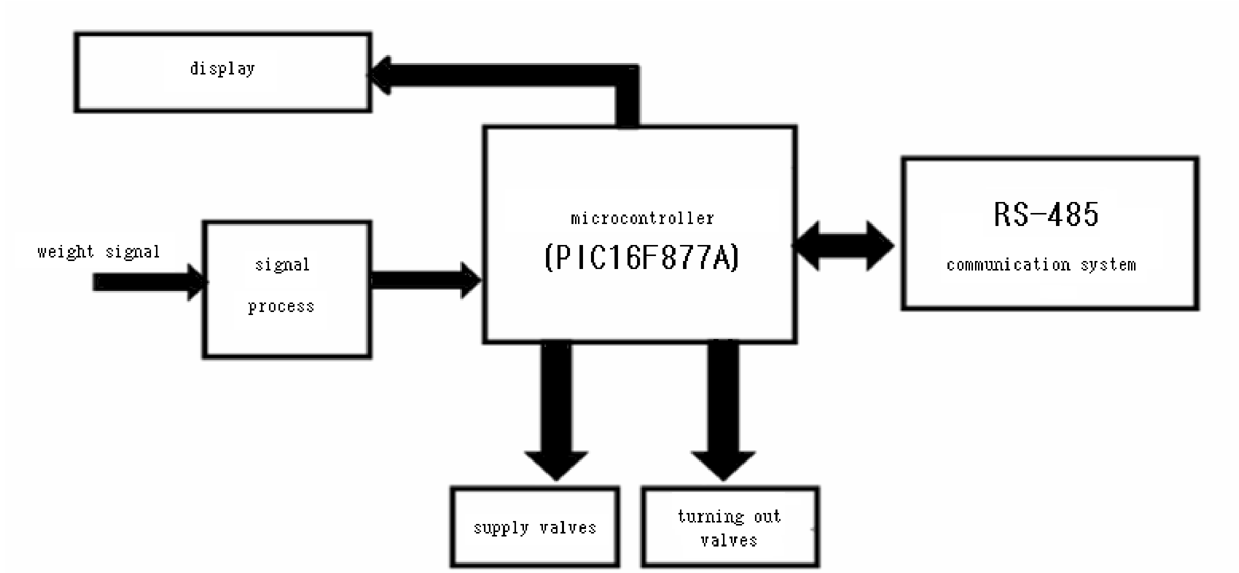

Figure 2. Block diagram of the of the determination feeder for the cosmetics batch

Microcontroller displays the measured weight data, controls the electronic valves, sets up the liquid supply amount, corrects the supply amount, communicates data with upper computer and controls the determination feed of liquid, and so on.

The communications protocol is MODBUS-RTU.

We have verified the effectiveness by the test about 6 liquid materials (water, glycerin, propylene, milistynic acid, squalene, liquid paraffin) with this device in D.P.R.K.(Sin Yi Zu Cosmetic Factory) from 4.2014 to 10.2016.

The specifications of the device are as follows.

Maximum supply amount (kg) : 999.99

Supply error(%) : 0.5

Supply speed (kg/min) : average 3

Outer box(mm) : 600 * 600 * 800

Weight(kg) : 7.5

Communication : RS-485

The technical economic effectiveness of the developed device that it is unaffected by temperature and humidity and takes an accurate measurement compared with determination manners used before(flowmeter) and can automatize the measuring and supply in liquid material mixing process.

The technical economic effectiveness of the device is given in Table 2.

Table 2. The technical economic effectiveness of the device

index	unit	before	now

error	%	5	0.5
measuring time	h	1	0.5
labor management	persons	3	1

Conclusions

In this paper, we considered a method of automatic quantitative supply of raw materials using mass sensor in cosmetics compounding process, and the automatic quantitative supply system was designed and manufactured

In addition, the technical characteristics of the system were clarified and introduced to the production process, contributing to the automation of cosmetic compounding process.

This system is applicable to the automatic quantitative supply for all viscous liquids.

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