

Development of PLC based Transdermal patch evaluation system

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ABSTRACT

System represent the basic adhesion which signify combination of all interfacial intermolecular interactions where "practical adhesion" present forces & work need to be disrupted of interfacial region to adhere the system. Basically thickness of adhesion cant identified by common techniques for that ideal practical adhesion test is outlined. Some of the adhesion measurement techniques are discussed briefly.

For the adherence all techniques are different. While identifying the adhesion involved difficulties are highlighted, and the unresolved problems are brought into sharper focus. Examination of failure surfaces carried out using analytical tools to ascertain the locus at failure is very important to understand mechanism.

Key words-programmable logic control, adhesion, substrate, peeling, load cell, motor, monitoring, controlling, test, transdermal drug delivery (tds), human machine interface, force, speed

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1. INTRODUCTION

System introduces the patch is peeled away which is adhered on substrate peeling of patch test is mechanical test used to determine adhesion strength. In the system patch is adhered on the substrate by adhesive is peeled from the test panel placed on the system, at different angle. Basically the adhesion strength is checked for joining purposes for different designs and application, today this test is used in medical industry to determine adhesion thickness of transdermal drug delivery patch. Different methods had been followed to identify the mechanism of adhesion many studies have presented which defines the mechanism of adhesion between the two dissimilar materials. the process is carried out for ten sample interval when recorded value is different from specified value then product fails the test monitor the patch during development of batch over the product shell life. When patch is adhered on the substrate peel force is applied & it is peeled from the test panel through servomotor this force is converted to electrical signal by the load cell and amplified by the converter and processed to programmable logic and displayed the record on human interface panel. The material can be vinyl chloride & co-polymers, & polyethylene & co-polymers, when the product is manufactured user of this standard responsible for safety, these test method are under of ASTM committee D09 it's an American standard. To prepare test sample we need 2 cutter of 12 and 24 mm width to cut, 12mm thick 200mm length 12mm wide, roller dimension is $8.5 \pm 25\text{mm}$ diameter, $45 \pm 1.5\text{mm}$ in width, weight $240 \pm 45\text{g}$, 6mm thickness covered with rubber. For preparing the sample remove 50mm/s(2 in/s) length of tape conditioning for room

temp $23 \pm 5^\circ (73 \pm 9^\circ \text{f})$, tape length is 450 m(8.in). Report should be of average width that is millimeter, or inches. Average thickness near to 0.0025mm (0.000/in)

2. LITERATURE REVIEW

Different methods are experimented for drug administration, like intravenous and intranasal ways .Novel dosage forms to target drug delivery, improves efficiency for drug delivery of patients. Common dosage (e.g. tablets, injectables, oral solutions), drug relies depends on the dose taken by patient in the form of cream or gel without control and monitoring. However, new dosage types require development of analytical techniques for their characterization. The methods developed should be stable consistent and product performance and be reproducible .TDDS are a novel dosage which relies on good adhesion for period of many hours or days to ensure proper drug delivery. Because if the poor adhesion and potential accidental dosing of children who may pick up fallen patches. Human skin test is reliable method for the evaluation, the time, safety and money involved in human test. Therefore, it is important to develop in vitro adhesion testing methodology. Drug-in-adhesive patches have been used for transdermal drug delivery in recent years. These patches may offer benefits such as painless and easy use in delivery of therapeutic levels of drug, reduced dose frequency compared to the conventional oral dosage forms, and hardly any gastrointestinal effect being reported with repeated administrations .In earlier days quality of patches is determined by manual testing. Due to manual testing parameters of patches are vary and degradation of quality of patches. So, we introduced these “development of programmable logic control based transdermal patch evaluation system” to maintain quality of patches. This system performs 180° & 90° test for checking quality of patches.



Fig .1 Hand operated roller

Theories of adhesion the definition of the word “adhesion” depends on whether the viewpoint is macroscopic or microscopic. However, it is important to realize an intimate contact between the adherend and the adhesive is necessary for the adhesion forces to be operative. The various theories of adhesion essentially differ in qualifying the nature of these inherent adhesion forces. None of these widely prevalent theories, however, is successful in satisfactorily explaining the entire existing adhesion phenomenon. These theories are briefly addressed here to highlight the essential concepts on which they are based.

3. AUTOMATION

automation or automatic control is the use of various control system for operating equipment such as machinery processes in factories, boilers and heat treating ovens ,switching in telephone networks, steering and stabilization of ships ,aircraft and other applications with minimal or reduced human intervention .some processes have been completely automated .the biggest benefit of automation that it saves labor, however it is also used to save energy and materials and to improve quality ,accuracy and precision. The term automation, inspired by the earlier word automatic (coming from automation), was not widely used before 1947, when general motors’ established the automation department. It was during this time that industry was rapidly adopting feedback controllers , which were introduced in the 1930s.Automation has been achieved by various means including mechanical ,hydraulic, pneumatic ,electrical, electronics and computers, usually in combination. Complicated system such as modern factories, airplanes and ships typically use all these combined techniques. Engineers can now have numerical control over automated devices. The result has been a rapidly expanding range of applications and human activities. Information technology, together with industrial machinery and processes, can assist

in the design, implementation, and monitoring of control. one example of an industrial control system is a programmable logic controllers are specialized hardened computers which are frequently used to synchronize the flow of inputs from (physical) sensors and events with the flow of outputs to actuators and events, human machine interfaces (HMI) or computer human interfaces(CHI),formerly known as man-machine interfaces, are usually employed to communicate with PLCs and other computers.

3. SYSYTEM DEVELOPMENT

3.1HARDWARE

3.1.1 LOAD CELL

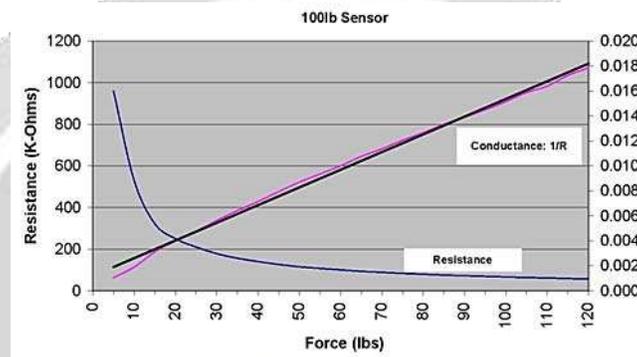


Chart 1 .Working Characteristics of Load Cell

View complete sensor specifications including physical properties, force ranges, and force specification

3.1.2 PLC

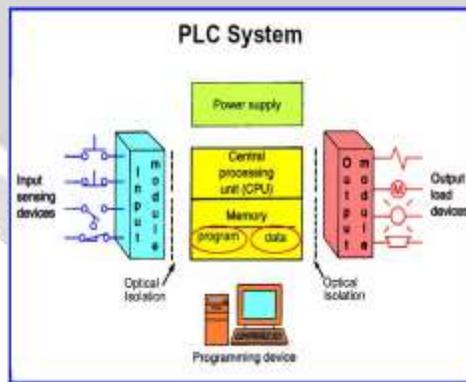


Fig .2 PLC

System Programmable controllers they are refereed as computer family. Used in industrial applications. A PLC accepts the Inputs from HMI, makes decisions by the ladder programming, and controls Outputs. Basically ladder On Boolean principals. Ladder diagrams are composed of different types of contact, coil and function block elements.

3.1.3 HMI



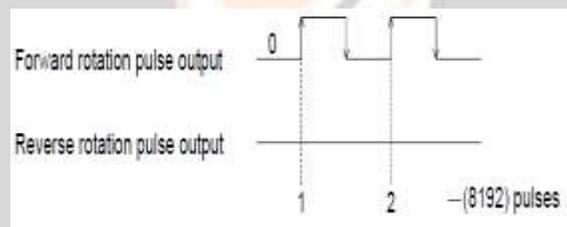
Fig .3 Graphical interfaces

The Human/Machine Interface is multi-function descriptor is “versatility”. Also have six programmable function keys, 64 registers that store numerical, and 4kbytes of user storage. The HMI can be programmed by using the included Graphic User Interface: The HMI Screen Builder, or by using escape codes.

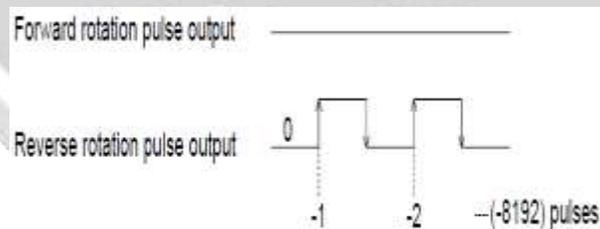
3.1.4 SERVO MOTOR

From the analysis motor encoder generates 8,192 pulses for one rotation, rotation.

Forward rotation command



Reverse rotation command



- **Drive mechanism**

The drive mechanism converts the rotation motion of the servo motor into the reciprocating or vertical motion through a speed reducer, timing belt, ball screw, etc. to move the machine.

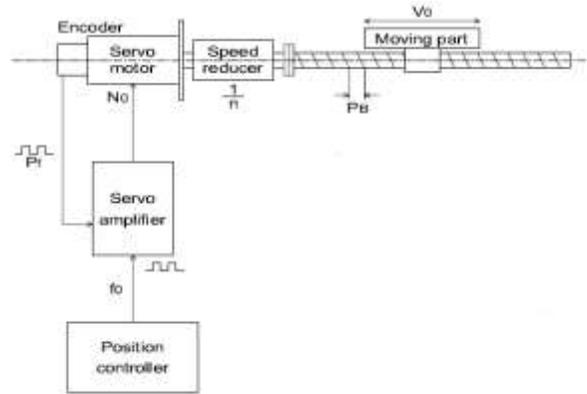


Fig .4 Drive mechanism

- D: Movement quantity per pulse (mm/pulse)
- V0: Moving part speed during quick feed (mm/min)
- N0: Number of rotations of motor during quick feed (r/min)
- PB: Lead of ball screw (mm/rev)
- 1/n: Speed reduction ratio
- Pf: Feedback pulse number (pulse/rev)
- f0: Command pulse frequency during quick feed (pulse/s)
- DS: Movement quantity per rotation of motor (mm/rev)

3.2 SOFTWARE

3.2.1 Programmable logic control

Flexi soft allows operator to monitor current conditions of a control system and, if necessary, to initiate a change in the operation of the system. Flexi soft connect to programmable logic controllers (PLCs) typically through the serial communications port. The Flexi logic can be programmed to monitor and/or change current values stored in the data memory of the PLC. Flexi soft are having graphics based displays with touch screen and keypad having function keys. Thus Flexi logic provides much more flexibility in preparing application.

4. RESULT

- Accuracy should be 1% of full scale.
- Force calculated in Newton per 10mm width (N/10mm).

$$\frac{\text{Meter per roll-weight of roll less core} \times \text{length of specimen mm}}{\text{Weight of specimen mm}}$$

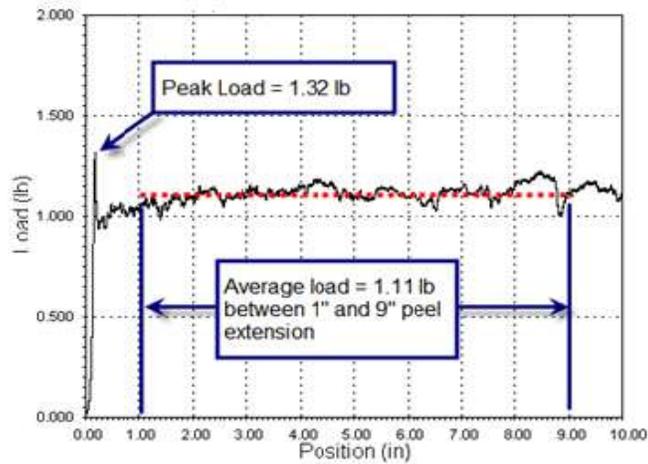


Chart2. Characteristic of load vs position

Specimen identifier	peel adhesion test
Test machine	PLC based transdermal patch system
Test software	Flexi logic
Date of manufacture	5/6/2017

TABLE 1. – Result analysis

Analysis result- Average Load over Extension Range

Average Load 1.11 Ib

Start point 1.000 in

End point 9.000 in

Maximum load

Load 1.32Ib

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