10:56

moodlecurrent.gre.ac.uk

PHAR 1056 Laboratory Report (RESIT) – Experimental write up

You will write up the laboratory report (max 2000 words) on only ONE of the experiments you have conducted.

The report should be analysing the data obtained, completing any appropriate calculations, discussing the results and answering questions from manual for ONE experiment. You can select any one of the four experiments.

You should discuss what could be improved, any problems faced during that experiments and how to overcome them or if the experiment did not work what the possible reasons and how to solve them.

The report should contain the following sections (also **please check the Marking Scheme document**):

1) You should start with a title, and then write a brief aims section, followed by an introduction and method. Please keep all of these sections short but concise. Please note, that your method section should be written in the past tense.

2) Results section where data is extracted and presented/analysed using tables, graphs, calculations, chemical equations etc. as appropriate. Make sure you clearly explain the stages of the data analysis so that your logic can be followed by the marker. (This will maximise your marks in the event that you make mistakes).

3) Discussion section where the results are commented on and explained. In this section you should also include comments on the critical steps in the experimental procedure and possible ways to improve the precision and accuracy of results (if necessary!).

4) Conclusions

5) In the lab manual, you will find questions posed in the text and points for specific discussion listed at the end. You do not need to answer these questions in the report, but you can use them to help with the discussion.

5

11:00
◀ Files
chrome://external-file

EXPERIMENT 1: TABLET FORMULATION & POWDER CHARACTERIZATION

Safety information

The chemicals listed below will be used in this experiment. The likely hazards associated with each of the chemicals are noted and recommended procedures for handling are given. You must read this page and the experimental description carefully before starting the experiment and before coming into the laboratory. Note any potential hazards and adopt precautions as your safe lab practice. When you are satisfied that you understand any possible difficulties that might arise and the recommended procedures for dealing with them, sign the declaration and have it initialled by a demonstrator. This must be done prior commencing lab work. At the beginning of the lab session demonstrators will quiz you about the safety information and experimental procedure in order to identify your ability to work safely and efficiently. If you fail to prove ability for safe and efficient work you will not be allowed to start lab practical. Please note, that it is your own responsibility to complete the lab practical during time that is allocated to you. Be sure to request information or help if you are in doubt on any point.
This experiment involves use of a moving machine which is potentially dangerous. Ensure hands are dry before equipment is switched on/off. Take great care when compressing powders to produce tablets. Avoid your fingers, clothes or hair getting caught anywhere on the machine.

All the materials used are in powder form and most are from everyday food substances which are not toxic. Do not however, taste any material as it may not be food grade and minimize contact with bare skin. Avoid inhaling the powders. Clean up any spillage of powder immediately.

Dispose of all used materials in designated waste containers / areas. Clean and replace equipment after use. Wash all glassware after use

Chemical	Hazard	Precautions
Paracetamol tablets	Toxic if swallowed	Do not ingest

Declaration - I have read and understood the contents of the safety information sheet and the script for the experiment

Signed (student): .....

Checked (demonstrator): ..... Date: .....

5

11:01
◀ Files
chrome://external-file

INTRODUCTION

Tablets are the most common dosage forms employed for oral administration of drugs. A single tablet will under normal circumstances contain different excipients each performing a specific function, for example, bulking agents (or fillers), binding agents, disintegrating agents, lubricants, and active pharmaceutical agents.

Different mixtures of these constituents will affect the final properties of the finished dosage form and their ultimate performance in the body. The properties of the tablets produced are also affected by manufacturing process variables such as the force used to compress the powdered excipients. Various tests need to be performed in order to characterise the properties of tablets. These tests provide information on the effects of the different formulation and manufacturing variables used. Such information will aid the decision for the best formulation and set of conditions for producing an ideal tablet that will be safe, effective and durable. Common tests include size (thickness and weight uniformity), hardness, friability, disintegration time and tablet dissolution.

The main aims of this experiment are the preparation (formulation) of tablets by directly compressing the constituent materials using a tablet press and investigating the effects of varying the tablet constituents and the manufacturing process on the properties of the tablet produced.

METHOD

Please follow these instructions carefully and check the diagrams overleaf for details of the tablet press and to familiarise yourself with the various parts and its operational principles. It is also of **UTMOST** importance, that all mixtures put through the press contain a minimum of 1.0 % magnesium stearate. This acts as a lubricant for the press, without which the lower punch will seize up and the die does not fill with mixture, which results in the tablet production coming to a stop.

1. Preparation of powdered / granular mixture (Mixing)

Follow the formulations shown in table 1 below to prepare the mixtures as follows:

1.1 Weigh out the powders separately. Mix thoroughly lactose, starch and talc in a mortar.

1.2 Add all of the excipients on a 250µm mesh and pass them through the mesh gently and pure the powder in a plastic container. Mix the powders well for 5min and label each formulation as Batch A or Batch B.

2. Production (compression) of tablets

2.1 Place the powder in hoper No 1 and compress the tablets as indicated in Table 2. The specifications for each tablet should be 10mm diameter and 300 mg weight. The first two groups should carry out the compression studies for batch A1 and the other two for batch A2. As it depicted in Table 2 the tablet compression force and dwell time are the variables for the powder studies.

Table 1: Tablet formulations

Ingredient/Formula	Formulation/Weights	
	A (g)	B (g)
Lactose	50	37.5
HPMC	12.5g	25.0
Talc	1.25	1.25
Magnesium stearate	0.625	0.625

5

11:01
◀ Files
chrome://external-file

2.2 Tablet characterization

a. Weigh together 5 tablets from each Batch (e.g A1, A2, etc.) and record the total weight.
b. From this total weight of 5 tablets, calculate the mean (average) weight per tablet and the standard deviation (SD).
c. Determine tablet hardness by measuring the force required to fracture a sample batch of 5 tablets using the Hardness Tester provided. Calculate the mean hardness (force) and the SD for each batch.
d. Determine the thickness of each tablet using the calliper provided and calculate the SD for each batch.
e. Provide three Tables including the average weight, hardness and thickness of each batch.

Table 2: Setting of compression force and dwell time for studying the compression behaviour of Batches 1&2.

Dwell Time (msec)	Tablet Compression Force (mPa)				
	30	50	100	150	200
5	A1/B1	A2/B2	A3/B3	A4/B4	A5/B5
10	A6/B6	A7/B7	A8/B8	A9/B9	A10/B10
5K	A11/B11	A12/B12	A13/B13	A14/B14	A15/B15
10K	A16/B16	A17/B17	A18/B18	A19/B19	A20/B20

*The tablet press settings will be adjusted by the demonstrators responsible for the practical.

3.1. Tablet weight uniformity and hardness

This is an official method and described in the Tablet Monograph (p459) and Appendix (p A211) of the British Pharmacopoeia (BP 2000). The specification is dependent on the weight of tablet.

Questions

The BP specification states that for tablets weighing more than 250mg, not more than two out of 20 tablets should deviate by more than 5%. In addition, not more than 1 tablet should deviate by more than 12.5% from the mean.

a. How many tablets had deviations > 5%?

b. Did your batch pass the uniformity test?

c. How useful is your experimental test on 10 tablets as far as the BP specification is concerned.

3.2 Tablet hardness

Questions

a. What is difference in hardness between A1 and A2? Give a reason for the difference
b. What effect does increasing the compression pressure (or force) have on tablet hardness (F1 and F2)?
c. What are the implications of having too soft or too hard tablets?

3.3. Heckel Plots

Many methods have been used to study the volume reduction mechanism and bond formation of pharmaceutical powders. The most frequently used method for studying the powder volume reduction process is the Heckel equation, or the porosity–pressure function, which is based on the assumption that the process of pore reduction during compression follows a first-order kinetic (Heckel, 1961). The parameters concerning compressibility characteristics can be obtained from the porosity–pressure plot. Yield pressure (P_y) is a measure of the plasticity of

materials and can be used for relative comparisons between different material compression

11:01
◀ Files
chrome://external-file

materials and can be used for relative comparisons between different material compression characteristics. A Heckel plot can be used to study plain materials, but it can also be used to study powder mixtures whose characteristics are usually a combination of plain material characteristics.

a. The Heckel equation is widely used for relating a powder bed's relative density (D) during compression to the applied pressure (P). The equation is written as follows:

$$\ln [1 / (1 - D)] = KP + A$$

b. The relative densities D, of the tablets can calculated from the equation:

$$V = D\, w/\rho_s \quad [2]$$

where V_t is the volume of tablet (cm^3) and ρ_s is the particle density of the solid material (g/cm^3). The ρ_s values for formulations A and B are 1.19 g/cm^3 and 1.57 g/cm^3, respectively.

Questions

a. Use the Heckel equation to provide the plot for each formulations A and B (one plot for each dwell time).
b. Calculate constants K and A and discuss the powder properties based on the Heckel plots.

References

M.E. Aulton. Pharmaceutics: The Science of Dosage Form Design. Churchil Livingstone Ed, New York, 2003.

EXPERIMENT 2: TABLET DISSOLUTION AND DRUG RELEASE

Safety information