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FORMULATION AND EVALUATION OF ASCORBIC ACID AND METRONIDAZOLE TABLETS CONTAINING MICROCRYSTALLINE CELLULOSE DERIVED FROM *ORYZA SATIVA*

***Abisoye, V. O., Oyi, A. R. and Apeji, Y. E**

Department of Pharmaceutics and Industrial Pharmacy, Faculty of Pharmaceutical sciences, Ahmadu Bello University, Zaria.

***Author for correspondence:** +2348032819514

ABSTRACT

The research aims to formulate and evaluate the tableting properties of microcrystalline cellulose derived from Oryza sativa chaff, which was used as a direct compression excipient in the formulation of ascorbic acid and metronidazole tablets. Portion of the samples of *Oryza sativa* chaff after cleaning and drying (300 g) was soaked in 500 mL of 17.5 % sodium hydroxide solution. The slurry obtained was maintained under constant stir for 1 h at room temperature. The pre-treated chaff was filtered at room temperature and then washed with 500 mL 95 % ethanol to remove the base; the sample was then dried in an oven at 60 ℃ for 24 h. Each of the sample was further mixed with 300 mL distilled water, 50 mL glacial acetic acid and 200 mL of sodium hypochloride. The mixtures were stirred on a water-bath at 75 ℃ for 2 h and the residue washed with 95 % ethanol and distilled water. Each of the extracted cellulose samples A and C (72.1 and 84.2 g) was added to a 1 L beaker containing 500 mL of 2.5 M hydrochloric acid and heated to a temperature of about 100 ℃ on a hot plate for 15 mins. The resulting crystalline cellulose was collected and filtered, then washed with aqueous ammonia solution and distilled water. This was dried at room temperature to constant weight. Physicochemical characteristics was done on the extracted materials to determine the suitability of varieties of MCC used as direct compression agent in formulation of ascorbic acid and metronidazole tablet in relation to the standard Avicel®PH-102. The chaff derived microcrystalline cellulose (CDMCC) obtained was light-yellow, tasteless powder with characteristic odour. FTIR spectral study showed that there was no chemical interaction and introduction of new peak across all the samples just like the Avicel®PH-102. The dilution potential CDMCC with respect to ascorbic acid was 60:40 with a tensile strength of 0.97 MN/m2 and metronidazole to be 50:50. The tablet properties of the respective formulation met the requirements in the British Pharmacopoeia. The dissolution studies showed that the Avicel®PH-102 gave better results than the CDMCC. The standard Avicel®PH-102 performed better than the microcrystalline cellulose extracted (CDMCC) as a direct compression agent in the formulation of ascorbic acid and metronidazole tablet. CDMCC from a good variety can serve as alternative to costly available direct compressible excipients such Avicel®PH-102 for immediate release tablets.

Keywords: Rice chaff, direct compressed, tablet, microcrystalline cellulose, ascorbic acid, metronidazole.

INTRODUCTION

Tablets are the typical used solid pharmaceutical dosage form and made up of mixtures of active pharmaceutical ingredients and excipients, usually in powder form, compressed from a powder into a solid dosage form (Avinash *et al*., 2013: Isah, 1996). A solid dosage form containing active drug with or without excipients is known as tablet (Onichabor, 2020). Tablet differ in shape, and vary to a large extent in sizes depending on the number of medicinal substances, weight, hardness, thickness, disintegration, dissolution properties and calculated mode

of administration (Orugun *et al*., 2020). The 70 % of total dispensed pharmaceutical dosage form as most medicaments are available except for those that posed a challenge in the formulation (Chandile *et al*., 2011).

In direct compression, fewer materials and unit operation may be required unlike the wet granulation method of tablet manufacturing (Bhavana & Reddy, 2023). Direct compression (DC) is viewed as the technique of choice for manufacture of tablets containing water sensitive and thermolabile materials (Jivraj *et al*., 2000). DC is the most cost-effective and easiest process for manufacturing since it only involves blending followed by compression (Alfa *et al*., 2004). Direct compression is the process by which tablets are prepared directly from the powder blends of active ingredients and suitable excipients without a preliminary granulation step (Mangal *et al*., 2015).

It is greatly influenced by material compressibility, flowability and dilution potential (Adeoye and Alebiowu, 2014). Carmago, (2011) reported that poorly compressible Active Pharmaceutical Ingredients (APIs) may not form compact during DC, hence the APIs will require higher concentration of excipients up to 80 % during tableting processes. This draw back necessitated the need to develop some newer excipients with an improve direct compression functionality (Thoorens *et al*., 2014). Yerima *et al*., 2023 assert that DC process requires additional materials or excipients that are known as filler-binders. At present, there are numerous excipients for direct compression in the market, with various advantages (Sulaiman and Sulaiman, 2020). Direct compression is the process of making tablets without the dry and wet granulation (Babawuro *et al*., 2023).

Microcrystalline Cellulose (MCC) is an excellent filler-binder known for great binding capacity because of the presence of large number of hydroxyl groups (OH) making the formation of hydrogen bonds possible which are known for strength and cohesiveness of compacts under lower compression forces (Vandana and Priyanka, 2012). MCC is partially depolymerized cellulose synthesized from alpha cellulose precursor obtained from fibrous plant material with mineral acid (Anis *et al*., 2019). Rice chaff is the shell covering the rice seed which is usually milled or removed as an agricultural waste after harvesting (Musa, 1999). Cellulose and some of its derivatives are produced from rice chaffs have been evaluated as ingredients for tableting (Musa, 1999: Omar *et al.,* 2022).

MATERIALS AND METHODS

Materials

The two (2) varieties of *Oryza sativa* chaff were obtained from selected local selected rice mills; *Oryza sativa* sippi, and *Oryza sativa* Nerica, Ascorbic acid (Scharlau, Spain), Metronidazole (Mallinckrodt Inc., USA) magnesium stearate (Aldrich, Germany), stearic acid (Sigma-Aldrich, Malaysia), talc (Sterling Organics, England), hydrochloric acid (BDH laboratory supplies, England), microcrystalline cellulose Avicel PH-102 (AcrosOrganics, USA), rice chaff locally processed from varieties of Oryza sativa (Nerica 8, Sippi) plant (Family Poaceae) in Northern region of Nigeria and identification was done at the Herbaria, Department of Botany, Ahmadu Bello University, Zaria and Institute of Agricultural Research and Development, Samaru Zaria with tagged number of ZAR-212348(1-2) and IARD-1890(1-2).

Methods

The method reported by Rizki *et al*., (2020) was adapted in the extraction of α-cellulose from the two (2) varieties of rice chaff with little modification. To 300 g each of the samples was cut into smaller pieces, cleaned with distilled water in order to remove dust and dirt adhering to them, followed by drying in an oven at 85 ℃. The dried small samples were further grounded to fine powder using electrical mill to increase the surface area. It was subjected to the processes below:

Dewaxing

Extractable materials like: fats and oil, waxes and resins were removed by subjecting each of the powder sample to ethanol extraction (95 %) in Soxhlet extractor at 60 ℃ temperature for 6 hours (h). The extract residue was dried at room temperature for 16 h and weighed afterward

Delignification and Alkaline Hydrolysis

After ethanol (95 %) extraction procedure, 20 g of the sample solid was transferred to a 250-ml flat-bottom flask, and 1000 ml of 7.5 % NaOH was added with continuous stirring for 1 h, fractional distillation was used to remove excess water followed by filtration and washing with 95 % alcohol. This then followed with drying. 20 g of the sample after drying is added with glacial acetic acid and 15ml of hypochlorite solution at 75 ℃ for 2 h The reaction mixture was allowed to cool and equilibrate for 24 h, and then the lignin-containing liquid was decanted. The decanted liquid placed in a 250-mL flask and 150 mL ice water added. The residue was washed with 95 % ethanol and distilled water. The sample is then dried in an oven at 65 ℃ for 24 h and the obtained yield were then taken for the 2 varieties.

Modification

The alpha cellulose was modified to microcrystalline cellulose by mineral acid (HCL) at 102 ℃ for 15 mins leaving microcrystalline cellulose after washing with water.

Percentage yield

The resulting cellulose from each variety was weighed and the percentage yields were determined from the weight of the initial sample which was noted as W0 and the final weight W_1 of cellulose. The percentage yield Y was then calculated as

$$Y = \frac{W1}{Wo} \chi \ 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots Equation\ 1$$

Fourier transform infrared (FTIR) spectroscopy

FTIR analysis was carried out using Perkin Elmer FTIR spectrophotometer 1650 using a scanning range of 4000.0cm^{-1} to 400 cm^{-1}. A (200 mg) portion of each sample was placed in sample holder.Each sample was scanned 64 times at a resolution of 4 cm-1 between 4000 and 650 cm-^{1} (Ohwoavworhua, *et al*., 2019)

Determination of Powder properties

2.5.1 Bulk and tapped densities

Portion of the powder (10 g) was poured through a glass funnel into a 50 mL measuring cylinder. The loose volume occupied by the powder was recorded as the bulk volume (v_b). Thereafter, the cylinder was subjected to 100 manuals tapping on a flat table surface for 5mins and the final volume after tapping was recorded as the tapped volume (v_t). The bulk (ρ_b) and tapped densities (ρ_t) were calculated using the following equations (Ohwoavworhua & Adelakun 2010).

$$\rho_b = {}^{m}/_{v_b} \quad \ldots\ldots \text{Equation 2}$$

$$\rho_t = {}^{m}/_{v_t} \ldots\ldots \text{Equation 3}$$

For each batch of powdered mix, the determinations were conducted in thrice. The mean and standard deviation was calculated and recorded.

2.5.2 Hausner's ratio

Hausner's ratio (HR) was computed as the ratio of the tapped (ρ_t) density to bulk density (ρ_b)

$$HR = \rho_t / \rho_b \quad \text{...Equation 4}$$

Carr's Index (CI)

The percentage difference between the tapped and bulk density was calculated using the equation below:

$$\mathbf{CI} = \frac{\text{Tapped density} - \text{Bulk density}}{\text{Tapped density}} \times 100 \quad \text{..Equation 5}$$

From the bulk and tapped density measurements, HR and CI were also calculated in triplicate

Particle size and Particle Size Distribution

This was determined by sieve method using Endecott's test sieve shaker. 10 g of the powder was agitated on the set of standard sieves (500, 250,150, 90, 75 μm opening and collecting pan) for 10 mins. The mean particle size of the powder was calculated from the percentage weight retained on each sieve (Olowosulu *et al.,* 2011).

$$\text{Mean Particle Size} = [\Sigma(\%\ \text{retained}) \times (\text{mean aperture})]/100 \quad \text{.....Equation 6}$$

Angle of repose

A portion of the extracted sample (10 g) was poured into a clean glass funnel clamped on a retort stand at 90^0 to the horizontal, such that the tip of the funnel was 10 cm from the flat table surface and the base of the funnel was blocked with a cotton wool. After removal of the cotton wool a powder heap was formed on a plane paper sheet. Angle of repose (θ) was measured as the angle made by the inclined plane of the powder heap with the horizontal according to the equation below (Mahmud *et al.,* 2022).

$$\text{Angle of repose, } \boldsymbol{\theta} = \text{Tan}^{-1}\ (^h/r) \quad \text{.....Equation 7}$$

Where h and r are the height of the heap, and the radius of the powder base respectively. For each batch the determinations were conducted in triplicate. The mean and standard deviation were calculated.

Flow rate

Flow rate was measured on Erweka flow rate tester. The time taken for 10 g of the granules to completely pass through the vibrating metal funnel was recorded (Aulton, 2013).

$$\textbf{Flow rate} = \frac{\text{Weight of powder (g)}}{\text{Time (s)}}$$

.....Equation 8

W = Weight of powder

T = Time taken for the powder to completely pass through the funnel. The determinations were conducted in triplicate and the mean and standard deviation were calculated.

Determination of dilution potential of Ascorbic acid and metronidazole with the CDMCC

Compacts containing binary mixtures of the chaff derived microcrystalline cellulose with ascorbic acid metronidazole was prepared in ratios (20:80, 40:60, 50:50, 60:40, 70:30, 80: 20) at compression pressure of 273 MNm-2 on a single punch hydraulic hand press (Carver Laboratory Press, Model C, USA) fitted with 6.2 mm and 8.4 die and flat-faced punches lubricated with a 1 % w/v

dispersion of stearic acid and talc in acetone. Tablet target weight was 250 mg and 400 mg respectively. The tablet analysis was carried out after the tablets were stored for at least 24 h to allow for elastic recovery and hardening. The crushing strength, diameter as well as the thickness of the tablets were determined. The tensile strength of the group of three tablets was calculated.

Formulation of ascorbic acid and metronidazole tablets by direct compression

Table 1 & 2 shows the formulae used for preparing ascorbic acid and metronidazole tablets respectively. Tablets were prepared by the process off direct compression using the method described by Apeji *et al*. (2011) with little modifications.

A powder mixture of the drug and direct compression excipient (CDMCC) were thoroughly mixed for 5 mins from the dilution potential blend of 40/60 for Ascorbic acid and 50/50 for Metronidazole tablet.

The sieved lubricants (250 µm aperture sieve) were added and tumbled for 1 min. The powder mix was compressed into tablets on a single punch hydraulic press (Carver press, USA) at compression pressure of 273 MNm-2. The tablet target weight was 250 mg for ascorbic acid tablets while 400mg for metronidazole tablets containing the CDMCC by using 6.2 mm die and 8.2 mm for metronidazole tablets respectively. Microcrystalline cellulose Avicel®PH-102 was used as basis for comparison. The tablets were evaluated for weight uniformity, crushing strength, friability, disintegration time as well as for the dissolution studies.

Table 1: Formula For Preparation of Ascorbic Acid Tablet Directly Compressed with The Excipients

S/N0	Ingredients	Formula for 1 tablet	Formula for 100 tablets
1	Ascorbic acid	100 mg	10 g
2	MCC	147.5 mg	14.75 g
3	Talc	1.25 mg	0.125 g
4	Magnesium stearate	1.25 mg	0.125 g
	Total	250 mg	25 g

Table 2: Formula For Preparation of Metronidazole Tablet Directly Compressed with The Excipients

S/No	Ingredients	Formula for 1 tablet	Formula for 100 tablets
1	Metronidazole	200 mg	20 g
2	MCC	196 mg	19.6 g
3	Talc	0.2 mg	0.2 g
4	Magnesium stearate	0.2 mg	0.2 g
	Total	400 mg	40 g

Evaluation of Tablet Properties

Tablet weight

Twenty (20) tablets randomly selected from each batch of the tablets containing ascorbic acid and metronidazole were weighed as a whole and individually, after which the average tablet weight was determined (Liu *et al*., 2018). The percentage coefficient of variation was calculated from the equation below:

% Coefficient of variation = Standard deviation / Mean weight X 100… Equation 10

Tablet Crushing Strength

Ten tablets (10) were selected from each batch of ascorbic acid and metronidazole tablets. Each tablet was placed in-between the plunger of the hardness tester (Monsato, England). The plunger was then screwed to apply force to the tablet via a compressed spring. The force at which the tablet fractured was read as indicated by a pointer that moved along the gauge on the barrel of the tester. The mean value was determined (Mohd *et al*., 2022).

Friability Test

Ten tablets from each batch of ascorbic acid tablets were determined using Erweka Friabilator (TA3R Erweka, Germany) at a rotation speed of 25 rpm for 4 mins. The tablets were introduced into the friabilator after taking the initial weight of the tablets. The tablets were removed at the end of 100 rpm, dusted and re-weighed (Apeji *et al*., 2024).

% Friability = Loss in weight / Initial weight X100… Equation 11

Disintegration time

This was done using Manesty disintegration apparatus (Manesty Machines Limited, Liverpool, UK) was performed on ascorbic acid tablets at 37 ± 1 ℃ in 200 mL of distilled water. The time taken for each tablet to disintegrate and pass through the mesh was noted (Okoye *et al*., 2014). The average of the disintegration time for six tablets was obtained and recorded.

Dissolution studies of tablets

Dissolution studies were carried out on each batch of ascorbic acid tablets using Erweka rotating basket dissolution apparatus (Erweka, GmbH, Germany). The dissolution medium used was 0.1 N HCl. One thousand millilitres of the dissolution medium was used during each study. The rotation speed was 50 rpm and the temperature was maintained at 37 ± 1 ℃. In each case, one tablet taken from each batch was placed in the basket and then lowered into the vessel containing 1000 mL of the dissolution medium. 5 mL of each sample was withdrawn at intervals of 5 min for 45 min. The initial volume of the vessel was maintained by replacing with 5 mL of the dissolution medium, maintained at 37 ± 1oC after each sampling. This was filtered through a Whatman number 1 filter paper. 1 mL of the filtrate was diluted with 9 mL of distilled water before analyzing spectrophotometrically (Apeji *et al*., 2020: Mujitapha, 2019). The samples containing ascorbic acid were

RESULTS AND DISCUSSION

Percentage yield

The sample yields were determined and data was summarized in Table 3. Microcrystalline celluloses were successfully extracted from two samples (A and C) of rice chaffs with percentage yields of 18 and 21 % respectively. Sample C was found to have the highest percentage yield using the alcohol-chemical extraction method. Rice chaff is made up of 22 % alpha cellulose according to Olamide and Oyawale (2012) when a Faro 58 variety was used for study. Other varieties were found to

have different percentage yield values due to different geographical sources, type of paddy, inherent properties like the growing conditions of the crop through hybridization, maturity and presence of impurities (Oduntan *et al*., 2012, Danish *et al*., 2016). Work-done by Ohwoavworhua *et al*. (2019), have the percentage yield value of MCC from rice chaff to be 15.2 % though the particular variety used was not started as the study further confirmed the variety determine yield.

Table 3: **Percentage Yield of Cellulose and Microcrystalline-Cellulose Produced from Varieties of Rice Chaff**

Varieties	Percentage yield (%) Microcrystalline cellulose
Sample A	18
Sample C	21

FTIR

Figures 1 to 3 shows the spectra recorded for the two samples and the Avicel®PH-102 that was used as the standard. The characteristics peaks of both the chaff derived microcrystalline cellulose (CDMCC) and standard remained the same upon FT-IR comparison with only slightly differences in wave numbers. The major peaks are identical to functional group in microcrystalline cellulose as observed, this shows a good reproducibility of the extraction method used in the study. Viera *et al*., (2007) asserted that absence of generation of new peaks against the standards shows no presence of other chemical agent. No new functional groups were observed in the two selected samples as seen on the Avicel spectrum as major functional groups present showed characteristic peaks in the IR spectrum (Forfang *et al*., 2017).

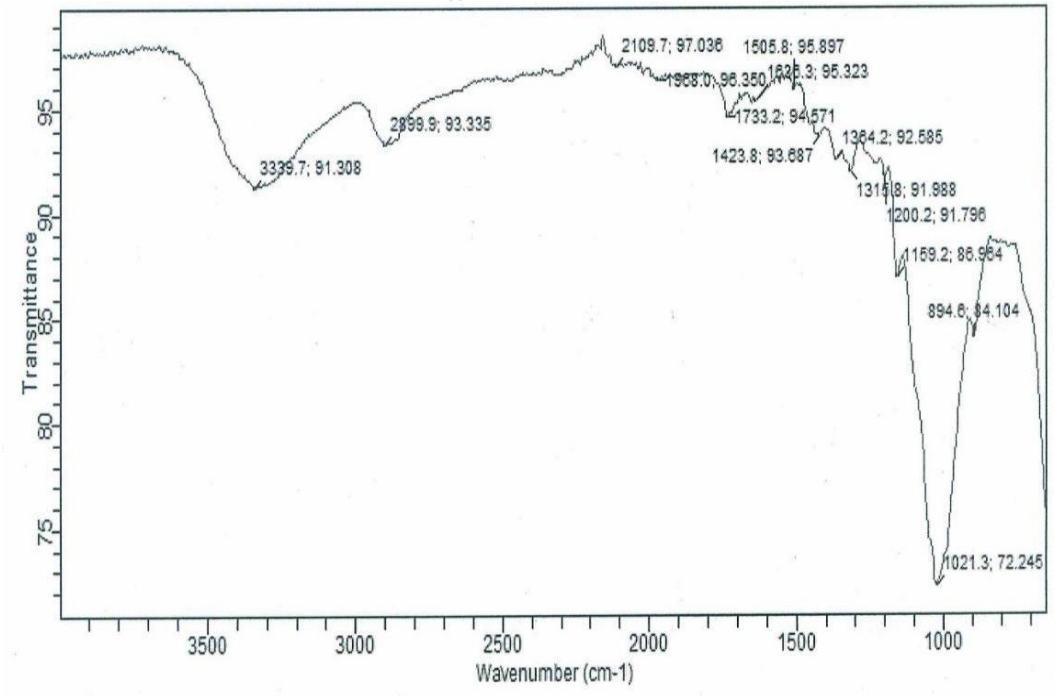

Figure 1: FTIR Spectrum for Sample A

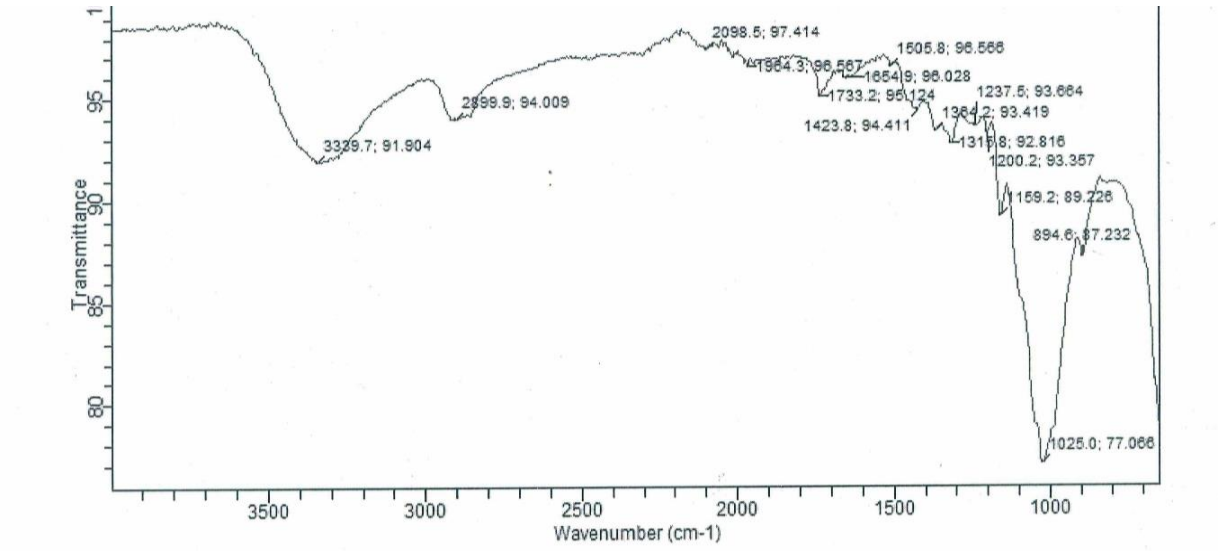

Figure 2: FTI-R Spectra for Sample C

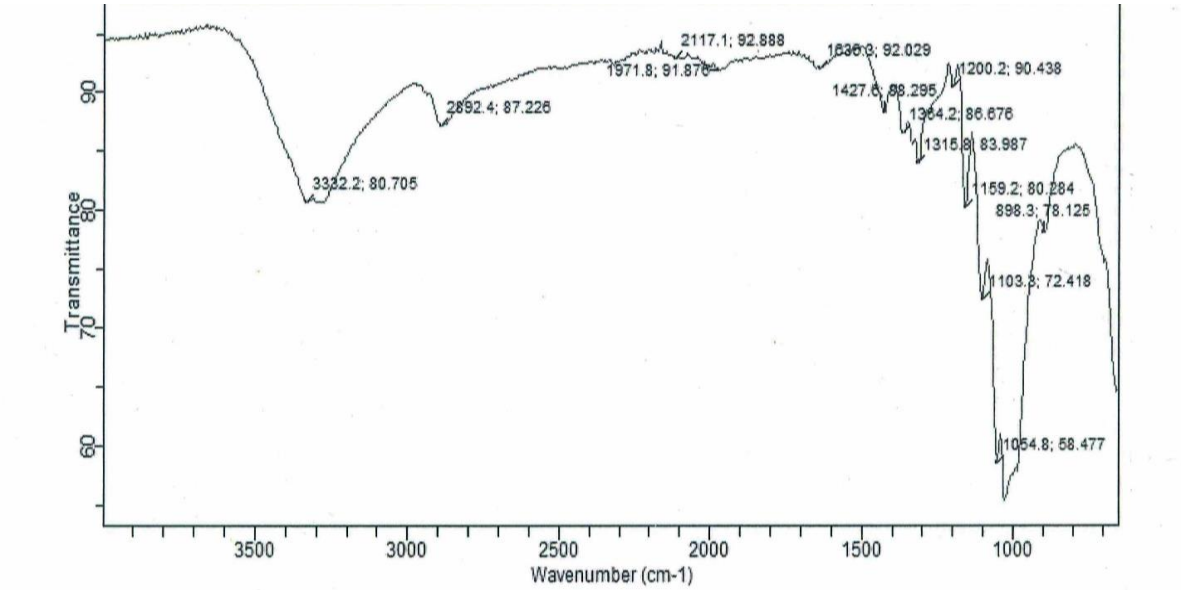

Figure 3: FTIR Spectra for Sample Reference

The standard particle (Avicel®PH-102) spectrum shows that the MCC has -0H group at wave numbers 3422, 3331, 3347 and 3360 $cm^{-1}$and the C-0 bond at 1635cm^{-1}, 1642-1649 cm^{-1} respectively. The spectra (Fig 1-3) were in agreement with work done on MCC by Rosa *et al*., (2012) in which the absence of peaks in the range of 1509-1609 cm^{-1} indicates C=C aromatic skeletal vibrations and the complete removal of lignin (Slywia *et al*., 2025).

Physicochemical parameters result

Upon characterisation of the powder property, as shown on tablet 5 below, samples A and C have relatively good flow properties of with flow rate of 1.71 and 1.46 g/sec and angle of repose 41^0 and 43^0 respectively. The angle of repose for pharmaceutical powders ranges from 25 –

45 ^{0}, the lower values indicate better flow (Staniforth and Aulton, 2007).

Table 4: Physiochemical properties of chaff derived microcrystalline cellulose and the standard avicel®PH-102 powder

Flow properties	Samples		
	A	C	Avicel®PH-102
Bulk density (g/cm)	0.244±0.02	0.227±0.02	1.29±0.02
Tapped density (g/cm)	0.333±0.01	0.312±0.01	0.417±0.01
Flow rate (g/sec)	1.79±0.7	1.46±0.6	3.88±0.1
Carr's Index (%)	26.82±1.8	27.20±1.6	22±1.2
Angle of repose (°)	41±0.99	42.8±1.03	36.2±0.2
Hausner's ratio	1.4±0.3	1.4±0.4	1.29±0.3

Formulation studies

The tablets were prepared by direct compression method. The method of direct compression was used because it has been reported by Nelson *et al*., (2000) that wet granulation of microcrystalline cellulose deteriorates the compression properties after wetting and drying. Tablets from all formulations were subjected to several in-process evaluations. The flow properties of a powder are essential in determine its suitability as a direct compression excipient. Orhwoavworhua and Adelakun (2010), consequently, magnesium stearate and talc were used to improve the flow properties as extra-granular excipients.

All tablet formulations passed the British pharmacopoeia (2012) as shown on tablet 5 and 6. The B.P. (2012) states that for tablets having mean weight between 130 – 325 mg, not more than 2 tablets are permitted to deviate from the mean greater than ± 7.5 % and no tablet more than ± 10 % and tablets above 325 mg no more than ± 5 % in mean weight is permitted. The significance of this test is to ensure that tablets in each batch of formulation fall within the official size range as any significant deviation could affect the chemical content of the formulation. Ayorinde *et al*. (2022) attributed poor flow of material during compression to presence of air in the bed. The average percentage weight variation for 20 tablets was within the official limits ranging 250 ± 0.9 mg to 250 mg ± 0.12

Table 5: Physiochemical Properties of Tablets from microcrystalline cellulose as direct compression excipients with Ascorbic acid formulation

Tablet Properties	CDMCC(A)	CDMCC(C)	Avicel®PH-102
Appearance	Milk colour	Milk colour	White
Mean tablet (mg)	251±0.8	250±0.9	250±0.12
Mean tablet thickness (mm)	2.41±0.03	2.40±0.06	2.40±0.08
Friability (%)	1.21±0.02	1.16±0.01	0.93±0.01
Mean tablet diameter (mm)	8.02±0.04	8.05±0.07	8.03±0.06
Mean crushing strength (kgf)	5.5±0.4	5.5±0.3	7.5±0.1
Disintegration time (min)	2.0±0.29	2.2±0.42	3.5±0.51

Table 6: **Physiochemical Properties of Tablets from microcrystalline cellulose as direct compression excipients with Metronidazole acid formulation**

Tablet Properties	CDMCC	CDMCC	Avicel®PH-102
Appearance	Light yellow	Light yellow	White
Mean tablet (mg)	402±3	401±4	401±2
Mean tablet thickness (mm)	3.04±0.2	3.07±0.3	3.00±0.2
Friability (%)	0.95±0.1	0.87±0.1	0.49±0.00
Mean tablet diameter (mm)	12.07±0.04	12.09±0.05	12.01±0.02
Mean crushing strength (kgf)	6.00±0.4	6.5±0.3	8.5±0.1
Disintegration time (min)	3.1±0.27	3.40±0.30	4.1±0.21

Lower crushing strength was observed for the ascorbic acid because the formulation targeted a lower dose (250mg) in relation to metronidazole that was formulated as 400mg tablet (Muhammed *et al.,* 2014). The disintegration time show the drug breaking into powder particle size. The time taken for a tablet to disintegrate when immersed in some test fluid has been a requirement in most compendia for many years and should not exceed 15 mins for uncoated tablets (BP, 2012). From this study, the disintegration time are 2.0, 2.2 and 3.5 mins for ascorbic acid and metronidazole 3.1, 3.40 and 4.1 mins for samples A, C and Avicel®PH-102. The low value is due to the floppy and light nature of the materials in relation to the standard. MCC has a very high intraparticulate porosity with approximate 90-95 % of the surface area being internal (Keles and Barcenas, 2015), the high porosity promotes swelling and disintegration of MCC tablets which is attributed to penetration of water into the hydrophilic tablet matrix by means of capillary action of pores and by disruption of the hydrogen bonds.

Dissolution Test

The results of in-vitro dissolution profile of ascorbic acid and metronidazole tablets are depicted in Figure 6 and 7 respectively. Ascorbic acid formulation with samples A, C and Avicel®PH-102 were found to have above 90 % drug release within 15 mins. For metronidazole formulation, the standard Avicel®PH-102 preparation gave 90.2 % drug release at 20 mins while higher percentage release was observed for the samples A and C preparations. A lower time drug release was observed for ascorbic acid formulations in comparison with the metronidazole formulation being a soluble drug.

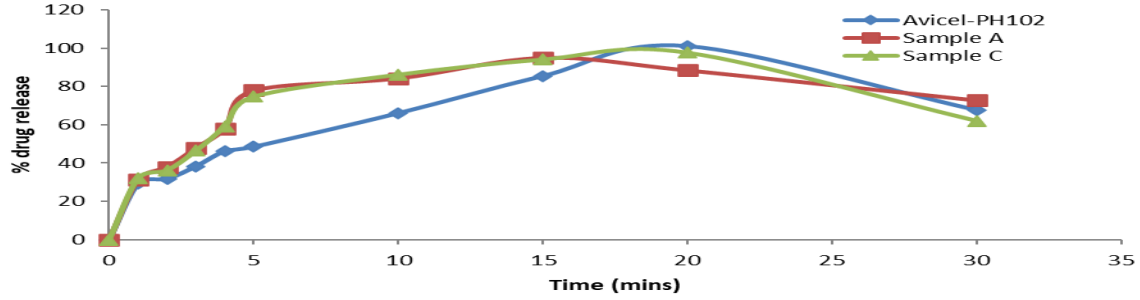

Figure 6: Drug release from CDMCC samples A, C and Avicel®PH-102 with Ascorbic acid tablets

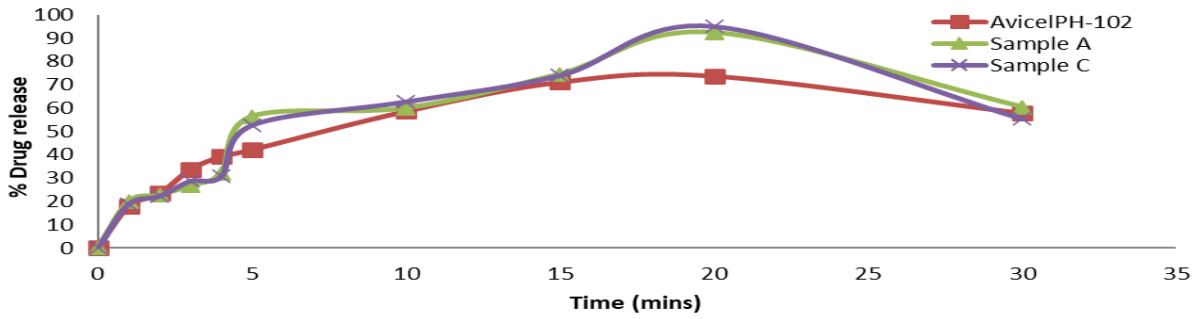

Figure 7: Drug release from CDMCC samples A, C and Avicel®PH-102 with metronidazole tablets

CONCLUSION

This work demonstrated the development of microcrystalline cellulose from two (2) chaff varieties as direct excipient for pharmaceutical use. Extraction of alpha cellulose and production of microcrystalline cellulose production from rice chaff was carried out using a standard extraction method from previous work done on agricultural source. The percentage yield value was found to be 18, and 21 % with sample C (*Oryza sativa* sippi) having highest percentage yield. All the physicochemical parameters (angle of repose, bulk and tapped densities, flow rate, Carr's index and Hausner's ratio) of samples A and C indicated a relatively good flow of powder in relation to the standard Avicel®PH-102. FTI-R was used to characterise the synthesised microcrystalline cellulose. The direct compressing effect of the synthesised microcrystalline cellulose was compared with those of the Avicel®PH-102 excipient in ascorbic acid and metronidazole tablet formulations and the attributes evaluated are in accordance with the official specifications (USP37-NF32 2014)

Recommendation

Further research and work could be carried on samples A and C to check for diluent and disintegration properties since their use as direct compression excipient has been further established from this study as they have a relatively good flow property. Selected samples A and C can be co-processed with suitable excipient like guar gum to improve its inherent characteristics

Conflict Of Interest

The authors have declared no conflict of interest.

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