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RECENT INNOVATIONS OF NOVEL DRUG DELIVERY SYSTEMS FOR FORMULATION, DEVELOPMENT AND EVALUATION OF PANDANUS ODORATISSIMUS EXTRACT CAPSULES AS NATURACEUTICAL FOR BREAST CANCER

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ABSTRACT

Cancer is a large group of diseases that can start in almost any organ or tissue of the body when abnormal cells grow uncontrollably, go beyond their usual boundaries to invade adjoining parts of the body and/or spread to other organs. Breast cancer is the most common cancer worldwide and leading cause of cancer death among women disproportionately affecting individuals in low- and middle-income countries. Use of medicinal plants and their products are almost doubled over the last decade in developing countries. The use of synthetic, natural, or biological agents to minimize the occurrence of cancer in healthy individuals is defined as cancer chemoprevention. Chemopreventive agents inhibit the development of cancer either by impeding DNA damage, which leads to malignancy or by reversing or blocking the division of premalignant cells with DNA damage. The success of using chemopreventive agents for protecting the high-risk populations from cancer indicates that the strategy is rational and promising. However, use of natural compounds for cancer prevention may mitigate associated toxicity. *Pandanus Odoratissimus* has antiviral, antiallergy, antiplatelet, anti-inflammatory, antioxidant, and anticancer action. The *Pandanus Odoratissimus* is medicinal plant widely distributed in Yemen. The flowers of *Pandanus Odoratissimus* were collected from Taiz, Yemen. The

objective of the present study was to prepare the extract of *Pandanus Odoratissimus* flowers as capsules delivery system which used for breast cancer. It was concluded that among the all formulations the formulation F1 is the best results of *Pandanus Odoratissimus* extract medicinal herbs capsules delivery system as an advanced phytotherapy approach for breast cancer according to the drug release was found to be 98.7% within 60 minutes.

KEYWORDS: *Pandanus Odoratissimus*, Extract, Capsules, Medicinal herbs**,** Breast cancer, Anticancer, Phytotherapy.

INTRODUCTION

Cancer is a large group of diseases that can start in almost any organ or tissue of the body when abnormal cells grow uncontrollably, go beyond their usual boundaries to invade adjoining parts of the body and/or spread to other organs. The latter process is called metastasizing and is a major cause of death from cancer. A neoplasm and malignant tumor are other common names for cancer. Cancer is the second leading cause of death globally, accounting for an estimated 9.6 million deaths, or 1 in 6 deaths, in 2018. Lung, prostate, colorectal, stomach and liver cancer are the most common types of cancer in men, while breast, colorectal, lung, cervical and thyroid cancer are the most common among women. The cancer burden continues to grow globally, exerting tremendous physical, emotional and financial strain on individuals, families, communities and health systems. Many health systems in low- and middle-income countries are least prepared to manage this burden, and large numbers of cancer patients globally do not have access to timely quality diagnosis and treatment. In countries where health systems are strong, survival rates of many types of cancers are improving thanks to accessible early detection, quality treatment and survivorship care.[1-3]

The use of synthetic, natural, or biological agents to minimize the occurrence of cancer in healthy individuals is defined as cancer chemoprevention. Chemopreventive agents inhibit the development of cancer either by impeding DNA damage, which leads to malignancy or by reversing or blocking the division of premalignant cells with DNA damage. The continuous increase in cancer cases, failure of conventional chemotherapies to control cancer, and excessive toxicity of chemotherapies clearly demand an alternative approach. The success of using chemopreventive agents for protecting the high-risk populations from cancer indicates that the strategy is rational and promising. Chemoprevention is a relatively safe and cost-effective approach because cancer can be prevented by changing dietary habits. This

approach has gained momentum after the approval of tamoxifen and raloxifen by US Food and Drug Administration for breast cancer risk reduction. Various epidemiological and preclinical studies have convincingly argued the role of several dietary agents to be involved in preventing occurrence of cancer as well as its treatment. Several clinical trials associated with chemopreventive properties of several natural compounds are ongoing. Drug associated toxicity is a significant barrier for currently available chemotherapeutic drugs. However, use of natural compounds for cancer prevention may mitigate associated toxicity.[2-5]

Background of Breast Cancer[1-5]

Breast cancer is the most common cancer worldwide and leading cause of cancer death among women disproportionately affecting individuals in low- and middle-income countries. The 5-year survival rates in high-income countries exceeds 90%, compared with 66% in India and 40% in South Africa.

Bridging inequities in breast cancer outcomes requires systematic improvements in access to resource-appropriate and quality services. The World Health Organization's Global Breast Cancer Initiative (GBCI), established in 2021, brings together stakeholders from around the world and across sectors with the shared goal of reducing breast cancer by 2.5% per year, which over a 20-year period would save 2.5 million lives.

Scope of the Problem: In 2022, there were 2.3 million women diagnosed with breast cancer and 670 000 deaths globally. Breast cancer occurs in every country of the world in women at any age after puberty but with increasing rates in later life. Global estimates reveal striking inequities in the breast cancer burden according to human development. For instance, in countries with a very high Human Development Index (HDI), 1 in 12 women will be diagnosed with breast cancer in their lifetime and 1 in 71 women die of it. In contrast, in countries with a low HDI; while only 1 in 27 women is diagnosed with breast cancer in their lifetime, 1 in 48 women will die from it.

Female gender is the strongest breast cancer risk factor. Approximately 99% of breast cancers occur in women and 0.5–1% of breast cancers occur in men. The treatment of breast cancer in men follows the same principles of management as for women. Certain factors increase the risk of breast cancer including increasing age, obesity, harmful use of alcohol, family history of breast cancer, history of radiation exposure, reproductive history (such as age that menstrual periods began and age at first pregnancy), tobacco use and postmenopausal

hormone therapy. Approximately half of breast cancers develop in women who have no identifiable breast cancer risk factor other than gender (female) and age (over 40 years).

Family history of breast cancer increases the risk of breast cancer, but most women diagnosed with breast cancer do not have a known family history of the disease. Lack of a known family history does not necessarily mean that a woman is at reduced risk. Certain inherited high penetrance gene mutations greatly increase breast cancer risk, the most dominant being mutations in the genes BRCA1, BRCA2 and PALB-2. Women found to have mutations in these major genes may consider risk reduction strategies such as surgical removal of both breasts or chemoprevention strategies.

Signs and Symptoms: Most people will not experience any symptoms when the cancer is still early hence the importance of early detection. Breast cancer can have combinations of symptoms, especially when it is more advanced. Symptoms of breast cancer can include: a breast lump or thickening, often without pain, change in size, shape or appearance of the breast, dimpling, redness, pitting or other changes in the skin, change in nipple appearance or the skin surrounding the nipple (areola), and abnormal or bloody fluid from the nipple is shown in Figure 1.

People with an abnormal breast lump should seek medical care, even if the lump does not hurt. Most breast lumps are not cancer. Breast lumps that are cancerous are more likely to be successfully treated when they are small and have not spread to nearby lymph nodes. Breast cancers may spread to other areas of the body and trigger other symptoms. Often, the most common first detectable site of spread is to the lymph nodes under the arm although it is possible to have cancer-bearing lymph nodes that cannot be felt. Over time, cancerous cells may spread to other organs including the lungs, liver, brain and bones. Once they reach these sites, new cancer-related symptoms such as bone pain or headaches may appear.

Treatment for breast cancer depends on the subtype of cancer and how much it has spread outside of the breast to lymph nodes (stages II or III) or to other parts of the body (stage IV). Doctors combine treatments to minimize the chances of the cancer coming back (recurrence). These include: surgery to remove the breast tumor, radiation therapy to reduce recurrence risk in the breast and surrounding tissues, medications to kill cancer cells and prevent spread, including hormonal therapies, chemotherapy or targeted biological therapies. Treatments for breast cancer are more effective and are better tolerated when started early and taken to

completion. Surgery may remove just the cancerous tissue (called a lumpectomy) or the whole breast (mastectomy). Surgery may also remove lymph nodes to assess the cancer's ability to spread. Radiation therapy treats residual microscopic cancers left behind in the breast tissue and/or lymph nodes and minimizes the chances of cancer recurring on the chest wall.

Advanced cancers can erode through the skin to cause open sores (ulceration) but are not necessarily painful. Women with breast wounds that do not heal should seek medical care to have a biopsy performed. Medicines to treat breast cancers are selected based on the biological properties of the cancer as determined by special tests (tumor marker determination). The great majority of drugs used for breast cancer are already on the WHO Essential Medicines List (EML). Lymph nodes are removed at the time of cancer surgery for invasive cancers. Complete removal of the lymph node bed under the arm (complete axillary dissection) in the past was thought to be necessary to prevent the spread of cancer. A smaller lymph node procedure called "sentinel node biopsy" is now preferred as it has fewer complications.

Medical treatments for breast cancers, which may be given before ("neoadjuvant") or after ("adjuvant") surgery, is based on the biological subtyping of the cancers. Certain subtypes of breast cancer are more aggressive than others such as triple negative (those that do not express estrogen receptor (ER), progesterone receptor (PR) or HER-2 receptor). Cancer that express the estrogen receptor (ER) and/or progesterone receptor (PR) are likely to respond to endocrine (hormone) therapies such as tamoxifen or aromatase inhibitors. These medicines are taken orally for 5–10 years and reduce the chance of recurrence of these "hormone-positive" cancers by nearly half. Endocrine therapies can cause symptoms of menopause but are generally well tolerated.

Cancers that do not express ER or PR are "hormone receptor negative" and need to be treated with chemotherapy unless the cancer is very small. The chemotherapy regimens available today are very effective in reducing the chances of cancer spread or recurrence and are generally given as outpatient therapy. Chemotherapy for breast cancer generally does not require hospital admission in the absence of complications. Breast cancers that independently overexpress a molecule called the HER-2/neu oncogene (HER-2 positive) are amenable to treatment with targeted biological agents such as trastuzumab. When targeted biological

therapies are given, they are combined with chemotherapy to make them effective at killing cancer cells.

Radiotherapy plays a very important role in treating breast cancer. With early-stage breast cancers, radiation can prevent a woman having to undergo a mastectomy. With later stage cancers, radiotherapy can reduce cancer recurrence risk even when a mastectomy has been performed. For advanced stages of breast cancer, in some circumstances, radiation therapy may reduce the likelihood of dying of the disease. The effectiveness of breast cancer therapies depends on the full course of treatment. Partial treatment is less likely to lead to a positive outcome.

Global Impact: Age-standardized breast cancer mortality in high-income countries dropped by 40% between the 1980s and 2020. Countries that have succeeded in reducing breast cancer mortality have been able to achieve an annual breast cancer mortality reduction of 2–4% per year. The strategies for improving breast cancer outcomes depend on fundamental health system strengthening to deliver the treatments that are already known to work. These are also important for the management of other cancers and other non-malignant noncommunicable diseases (NCDs). For example, having reliable referral pathways from primary care facilities to district hospitals to dedicated cancer centers. The establishment of reliable referral pathways from primary care facilities to secondary hospitals to dedicated cancer centers is the same approach as is required for the management of cervical cancer, lung cancer, colorectal cancer and prostate cancer. To that end, breast cancer is a so-called index disease whereby pathways are created that can be followed for the management of other cancers.

WHO Response: The objective of the WHO Global Breast Cancer Initiative (GBCI) is to reduce global breast cancer mortality by 2.5% per year, thereby averting 2.5 million breast cancer deaths globally between 2020 and 2040. Reducing global breast cancer mortality by 2.5% per year would avert 25% of breast cancer deaths by 2030 and 40% by 2040 among women under 70 years of age. The three pillars toward achieving these objectives are: health promotion for early detection; timely diagnosis; and comprehensive breast cancer management. By providing public health education to improve awareness among women of the signs and symptoms of breast cancer and, together with their families, understand the importance of early detection and treatment, more women would consult medical practitioners when breast cancer is first suspected, and before any cancer present is advanced.

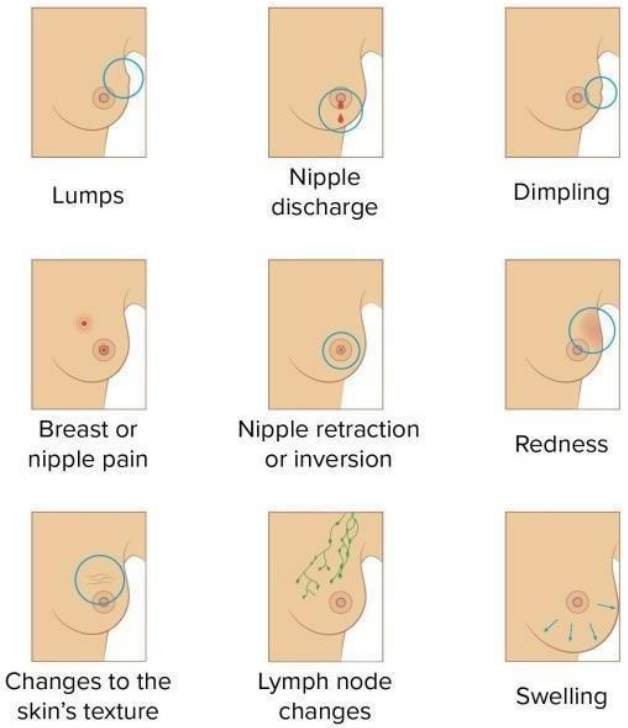

Fig. 1: Signs and Symptoms of Early Detection of Breast Cancer.

WHO Traditional Medicine Strategy[6-13]

Strategic Actions for WHO: Develop or update WHO technical documents and tools on promoting the safety, quality and effectiveness of T&CM practice and practitioners, including benchmarks for training and practice. Strategic objectives, strategic directions and strategic actions, organize training workshops on capacity building for regulators, and facilitate information sharing and the development of an international network of regulators.

In many parts of the world, policy-makers, health professionals and the public are wrestling with issues regarding the safety, effectiveness, quality, availability, preservation and regulation of traditional and complementary medicine (T&CM). T&CM continues to be widely used in most countries, and its uptake is increasing rapidly in other countries. At the same time, interest in T&CM is expanding beyond products to focus on practices and practitioners. As a result, WHO carried out a comprehensive analysis of the current status of T&CM around the world and worked with experts to develop the WHO Traditional Medicine Strategy 2014–2023.

Traditional Medicine (TM): Traditional medicine has a long history. It is the sum total of the knowledge, skill, and practices based on the theories, beliefs, and experiences indigenous to

different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness. Complementary Medicine (CM): The terms "complementary medicine" or "alternative medicine" refer to a broad set of health care practices that are not part of that country's own tradition or conventional medicine and are not fully integrated into the dominant health-care system. They are used interchangeably with traditional medicine in some countries.

The strategy aims to support Member States in developing proactive policies and implementing action plans that will strengthen the role TM plays in keeping populations healthy.

It seeks to build upon the WHO Traditional Medicine Strategy 2002–2005, which reviewed the status of TM globally and in Member States, and set out four key objectives: n policy, integrate TM within national health care systems, where feasible, by developing and implementing national TM policies and programmes, safety, efficacy and quality, promote the safety, efficacy and quality of TM by expanding the knowledge base, and providing guidance on regulatory and quality assurance standards. access, increase the availability and affordability of TM, with an emphasis on access for poor populations, rational use, promote therapeutically sound use of appropriate TM by practitioners and consumers.

Despite significant progress made in implementing this strategy around the world, Member States continue to experience challenges related to: development and enforcement of policy and regulations, integration, in particular identifying and evaluating strategies and criteria for integrating TM into national and primary health care (PHC), safety and quality, notably assessment of products and services, qualification of practitioners, methodology and criteria for evaluating efficacy, ability to control and regulate TM and CM (T&CM) advertising and claims, research and development; education and training of T&CM practitioners, information and communication, such as sharing information about policies, regulations, service profiles and research data, or obtaining reliable objective information resources for consumers.

The new strategy document aims to address these challenges. Member States can rise to these challenges by organizing their activities in the following three strategic sectors: Build the knowledge base that will allow T&CM to be managed actively through appropriate national policies that understand and recognize the role and potential of T&CM, strengthen the quality

assurance, safety, proper use and effectiveness of T&CM by regulating products, practices and practitioners through T&CM education and training, skills development, services and therapies, and promote universal health coverage by integrating T&CM services into health service delivery and self-health care by capitalizing on their potential contribution to improve health services and health outcomes, and by ensuring users are able to make informed choices about self-health care.

Evolution of the WHO TM Strategy 2014–2023: The strategy document is intended to provide information, context, guidance and support to policymakers, health service planners, public health specialists, traditional and complementary medicine communities and other interested parties about T&CM, including products, practices and practitioners. It addresses issues in evaluating, regulating and integrating T&CM, as well as in harnessing its potential to benefit the health of individuals. The need for a new strategy WHO and its Member States believe it is important to update and enhance the strategy at this time for a number of reasons: Continued uptake of T&CM, T&CM has growing economic importance, the global nature of T&CM, Levels of education, accreditation and regulation of T&CM, practices and practitioners vary considerably, recent advances in T&CM research and development, and intellectual property.

Global Regulatory Cooperation Network for Herbal Medicines (IRCH): In recent years, there has been an increased focus on regional and international collaboration on regulating medicinal products. Herbal medicines have been a specific workshop topic at meetings of the International Conference of Drug Regulatory Authorities (ICDRA) since 1986. In the T&CM sector, national regulatory authorities responsible for the regulation of herbal medicines have been meeting annually since 2006 as part of the global regulatory network of the International Regulatory Cooperation on Herbal Medicine (IRCH).

Described Risks Associated with T&CM: Products, practitioners and self-care: Use of poor quality, adulterated or counterfeit products, unqualified practitioners, misdiagnosis, delayed diagnosis, or failure to use effective conventional treatments, exposure to misleading or unreliable information, direct adverse events, and side effects or unwanted treatment interactions.

***Pandanus Odoratissimus*[14-40]**

Pandanus Odoratissimus is medicinal plant widely distributed in Yemen, is shown in Figure 2. The plant *Pandanus Odoratissimus* (synonyms: *Pandanus fascicularis Lam.*), belongs to the family Pandanaceae, *Pandanus Odoratissimus L*. known as Kathi in the South-West Asia (Yemen) and in the South of Arabic peninsular in Aseer and Theeffar. In Yemen Kathi is found widely in AL-Hodeidah (Tehama, Surdud Valley, Bura Valley), Taiz (Albarh, Alhujjareah), Abyan, and Lahaj. *Pandanus Odoratissimus L*.) is a stout, branching, often multi-stemmed, large shrub or small tree (2-4), (14-18) m in height, with about the same canopy spread. Plants of spiny trunks. Wild seedling - derived plants often have a single bole or trunk for 4-8m before forking. Maximum stem diameter is 12-25 cm. In Yemeni traditional medicine, the fresh floral axis (peduncle) is used to treat *Nocturnal Enuresis* in children. In Indian Ayurvedic medicines for treatment of headache, rheumatism, spasm, cold/flu, epilepsy, wounds, boils, scabies, leukoderma, ulcers, colic, hepatitis, smallpox, leprosy, syphilis, and cancer and as a cardiotonic, antioxidant, dysuric, and aphrodisiac. *Pandanus Odoratissimus* has antiviral, antiallergy, antiplatelet, anti-inflammatory, antioxidant, and anticancer action.

Fig. 2: *Pandanus Odoratissimus* Flowers.

Capsule Dosage Form[41-43]

Capsules are a common form of dosage for oral administration of pharmaceutical and nutraceutical products. They are produced in various shapes, sizes and materials, each capsule generally containing a single dose of active ingredient. In addition to the active drug ingredient or principal nutrient, other excipients are incorporated into the fill material, including antimicrobial preservatives, fillers, flavoring agents, sweeteners and coloring agent. Branding and dosage information may be printed on the outer surface of the capsule medication or ingredients inside the capsule may be in solid, liquid or paste form, depending on the drug component or, in the case of nutraceuticals, on the form of the main nutrient.

In the present study the *Pandanus Odoratissimus* flowers freeze -dried extract powder solid dosage form capsules delivery system was prepared and evaluated as an advanced phytotherapy approach for breast cancer.

MATERIALS AND METHODS

The flowers of *Pandanus Odoratissimus* were collected from Taiz, Yemen. *Pandanus Odoratissimus* flowers extract was prepared and gift from (Prof Dr. Amina El-Shaibany, Professor Dr. of Pharmacognosy, Department of Pharmacognosy, Faculty of Pharmacy, Sana'a University, Sana'a, Yemen). Hard Gelatin Capsules (Size 00), Croscarmellose Sodium, Starch, Magnesium Stearate, Colloidal Silicon Dioxide (Aerosil), 0.1NHCl Buffer, Potassium Dihydrogen, Disodium Hydrogen Phosphate and Sodium Hydroxide, gift from (Global Pharmaceutical Industry Company-Yemen).

Determination of The Cytotoxicity Inhibition of *Pandanus Odoratissimus* Extract

The efficacy of *Pandanus Odoratissimus* flowers extract against breast cancer using the MTT assay method was studied in Cairo on type cells MCF-7 according to the pervious results of research study of Prof Dr. Amina El-Shaibany. The results of study shown that the effectiveness of *Pandanus Odoratissimus* flowers extract against breast cancer cells in the way of MTT assay on MCF-7 cells and it was found that the effectiveness of *Pandanus Odoratissimus* flowers against breast cancer is strong as IC50 = 20.6 mg /ml and the rate of inhibition 78.75%.

Formulation and Evaluation of *Pandanus Odoratissimus* Extract[44-78]

Determination of The Organoleptic Properties of Extract

The following organoleptic properties of the extract were assessed: physical appearance, odor and taste. For these samples of *Pandanus Odoratissimus* extract was inspected and assessed using the natural senses (e.g. eyes, nose, mouth).

Determination of The Solubility of Extract

The solubility of a substance fundamentally depends on the solvent used as well as on temperature and pressure. The extent of solubility of a substance in a specific solvent is measured as the saturation concentration where adding more solute does not increase its concentration in the solution. Oral ingestion is the most convenient and commonly employed route of drug delivery due to its ease of administration, high patient compliance, cost-effectiveness, and flexibility in the design of dosage form. As a result, many of the generic

drug companies are inclined more to produce bioequivalent oral drug products. So, the solubility application according to standard parameters of solubility as shown in Table 1.

Table 1: Standard Parameters of The Solubility.

Description	Part of The Solvent Required Per Part of Solute
Very Soluble	Less than 1
Freely Soluble	From 1 to 10
Soluble	From 10 to 30
Sparingly Soluble	From 30 to 100
Slightly Soluble	From 100 to 1000
Very Slightly Soluble	From 1000 to 10,000
Practically Insoluble	More than 10,000

Formulation of *Pandanus Odoratissimus* Extract Capsules[44-78]

A uniform powder is obtained by mixing the *Pandanus Odoratissimus* extract of with the appropriate adsorbent and diluent as starch, disintegrate as croscarmellose sodium, lubricant as magnesium stearate, and glidant as colloidal silicon dioxide (Aerosil), the materials filled into the capsules as shown in Table 2.

Table 2: Composition of *Pandanus Odoratissimus* Extract Capsules.

Ingredients	Quantity Per Capsule (mg)			
	Formulation Code			
	F1	F2	F3	F4
***Pandanus Odoratissimus* Extract**	50%	50%	50%	50%
Starch	33%	38%	43%	45.5%
Croscarmellose Sodium	15%	10%	5%	2.5%
Colloidal Silicon Dioxide (Aerosil)	1%	1%	1%	1%
Magnesium Stearate	1%	1%	1%	1%

Evaluation of *Pandanus Odoratissimus* Extract Capsules[44-78]

Determination of Moisture Content of *Pandanus Odoratissimus* Extract

There are numerous methods for water content analysis (e.g. oven method, infrared drying method, microwave drying method, titration methods, chemical extraction of water, refraction method, and electrolytic method, etc. For this study, the shell of the capsules was removed and the moisture level of the contents of the capsules determined by using the moisture content analyzer.

Determination of Uniformity of Weight and The Amount of *Pandanus Odoratissimus* Extract Capsules

For the determination of the uniformity of weight, the British Pharmacopoeia method was used. Twenty of the *Pandanus Odoratissimus* capsules prepared were taken at random, their contents individually weighed and the average weight (mass) of the content determined. Not more than two of the individual weights (masses) had to deviate from the average weight (mass) by more than 7.5% and none of the deviates by more than twice that percentage. The amount of powder actually filled into the capsules was also compared with the desired quantity and the difference between the desired and actual quantity calculated. The formulation, 250mg of *Pandanus Odoratissimus* extract was to be filled in one capsule. Twenty capsules were thus randomly chosen, their contents weighed, the percentage difference between this and the desired weight calculated and averaged for the 20 capsules to assess the accuracy of the filling process.

***In-Vitro* Dissolution Studies of *Pandanus Odoratissimus* Extract Capsules**

The dissolution test measures the rate at which a drug is released into solution from a dosage form and is used as an indication of the bioavailability of a pharmaceutical product and of product quality. In this study the basket method was used. The quantitation of the amount of extract dissolved was measured based on UV absorbance measured at 325nm, the wavelengths for maximum UV absorbance of solutions of the *Pandanus Odoratissimus* extract determined by using a UV-Vis Spectrophotometer. For the dissolution study the following requirements and procedure were used: Apparatus: Basket. Medium: buffer 0.1NHCl. Volume of medium: 900ml. Temperature: 37±0.5℃. Rotation speed: 75 rpm. Dissolution time: 15, 30, 45 and 60 minutes.

RESULTS AND DISCUSSION

The Organoleptic Properties of The Freeze -Dried of *Pandanus Odoratissimus* Extract

As shown in Table 3, the organoleptic properties of the freeze -dried extract.

Table 3: The Organoleptic Properties of *Pandanus Odoratissimus* Extract.

Proprieties	***Pandanus Odoratissimus* Extract**
Physical Appearance	Brittle, Free-Flowing, Small Particulate Powder
Taste	Bitter
Odor	Characteristic Odor
Color	Darker Brown
Moisture Content	0.95%.

The Solubility of The Freeze -Dried of *Pandanus Odoratissimus* Extract

The results obtained in the solubility testing of the extract *Pandanus Odoratissimus* show that the extract is sparingly soluble in water as shown in Table 4.

Table 4: The Solubility Evaluation in Different pH.

Type of Solvent	Solubility of Extract
Water	Sparingly Soluble
HCl (0.1N)	Very Soluble
NaOH (0.1N)	Freely Soluble

Moisture Content of *Pandanus Odoratissimus* Extract

Moisture content is an important parameter for capsule dosage form and it is also important for herbal medicines, which are hygroscopic. The percentage of moisture content of *Pandanus Odoratissimus* was 0.95% as shown in Table 3.

Evaluation of *Pandanus Odoratissimus* Extract Capsules

Uniformity of Weight and Content of *Pandanus Odoratissimus* Extract Capsules

The results of the uniformity of weight and content of the *Pandanus Odoratissimus* capsules were calculated. The average deviation in weight from average for *Pandanus Odoratissimus* capsules were ± 0.2% and the average total content per capsule 97% within the limit on the acceptable deviation in weight average for capsules is ±7.5% and within the limit on the amount of content in the capsules 90% to 110%. The results indicated that the *Pandanus Odoratissimus* capsules within the limit of British Pharmacopoeia specifications.

***In-Vitro* Dissolution Studies**

The results of *in-vitro* dissolution of formulations in buffer 0.1NHCl at time interval (15, 30, 45 and 60 minutes) by using digital dissolution tester at (37± 0.5°C).

Table 5: The Drug Release Percentage of *Pandanus Odoratissimus* Extract Capsules.

Formulation Code	Drug Release %			
	Time (min)			
	15	30	45	60
F1	56.9	97.1	97.3	98.7
F2	33.5	94.6	94.9	97.3
F3	54.3	76.4	79.3	81.4
F4	53.6	66.9	74.1	79.3

The *in-vitro* dissolution of *Pandanus Odoratissimus* extract capsules is one important of the results of dissolved active ingredient *Pandanus Odoratissimus* extract, as shown in Table 5.

The results of formulations have shown that the drug release of F1 was found to be 97.1% within 30 minutes. In addition, the average drug release of F2, F3 and F4 were found to be 94.6%, 76.4% and 66.9% within 30 minutes respectively. The results of formulations have shown that the drug release of F1 was found to be 98.7% within 60 minutes. In addition, the average drug release of F2, F3 and F4 were found to be 97.3%, 81.4% and79.3% within 60 minutes respectively. it was concluded that the formulation of *Pandanus Odoratissimus* extract capsules F1 can be taken as an optimized capsules according to the drug release 98.7% within 60 minutes. So, it was found to be among the all formulations F1 was the best formulation.

CONCLUSION

It was concluded that among the all formulations the formulation F1 is the best results of *Pandanus Odoratissimus* extract medicinal herbs capsules delivery system as an advanced phytotherapy approach for breast cancer according to the drug release was found to be 98.7% within 60 minutes.

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