ANTICANCER ACTIVITY OF N-HEXANE EXTRACT FROM SPHAGNETICOLA TRILOBATA (L.) J.F PRUSKI AGAINST MCF-7 BREAST CANCER CELL

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Abstract: Sphagneticola trilobata (L.) J.F. Pruski is one of the perennial herbs that is widely used by the national and international community to treat various diseases including cancer. The objective of this study was to assessment the anticancer activity of n-hexane extract of S. trilobata leaves for inhibiting the growth of MCF-7 breast cancer cells in vitro by MTT (microculture tetrazolium salt) method. The n-hexane extract of sernai leaves was obtained from the maceration process of samples that were collected from the Langsa city, Aceh. The cytotoxicity test was carried out by incubating MCF-7 cells which had been exposed to several series of sample levels, viz. 1000; 500; 100; 50; 25; 10; 5 and 1 µg/mL. LC_{50} values are calculated using probit analysis. The results revealed that the n-hexane extract of S. trilobata leaves was cytotoxic against breast cancer cells (MCF-7) with an LC_{50} value of 0.037 µg/mL.

Keywords: Sphagneticola trilobata, MTT assay, MCF-7

Abstrak: Sphagneticola trilobata (L.) J.F. Pruski merupakan salah satu tanaman herbal yang digunakan secara luas oleh masyarakat nasional dan internasional untuk mengobati berbagai penyakit termasuk kanker. Penelitian ini bertujuan untuk mengetahui aktivitas antikanker ekstrak n-heksana daun S. trilobata dalam menghambat pertumbuhan sel kanker payudara MCF-7 secara in vitro dengan metode MTT (microculture tetrazolium salt). Ekstrak n-heksana daun sernai diperoleh dari proses maserai sampel yang dikoleksi dari kota Langsa, Aceh. Uji sitotoksisitas dilakukan dengan menginkubasi sel MCF-7 yang telah dipaparkan beberapa seri kadar sampel yaitu 1000, 500, 100, 50, 25, 10, 5 dan 1 µg/mL. LC_{50} dihitung dengan menggunakan analisa probit. Hasil penelitian menunjukkan bahwa ekstrak n-heksana daun S. trilobata bersifat sitotoksis terhadap sel kanker payudara (MCF-7) dengan harga LC_{50} sebesar 0,037 µg/mL.

Kata kunci: Sphagneticola trilobata, MTT assay, MCF-7
Introduction

Breast cancer is the most commonly diagnosed neoplasm with an incidence of death of 60% in developing countries (Wu et al., 2019). This type of cancer attacks women about 23% every year as a new case (Garbi et al., 2015) that occurs due to the abnormal cell growth in breast tissue. Handling and treatment are slow in patients causing cancer is in an advanced stage and difficult to control (Rahmawati et al., 2013).

Some treatments to overcome cancer have been performed viz. surgery, radiation, and chemotherapy. However, these efforts have a negative effect. Improper surgery causes the disease to become more severe if it can spread to other parts of the body. Radiation can be toxic to normal cells because it works not selectively. Chemotherapy or the administration of anticancer drugs such as taxol, bleomycin, doxorubicin, chlorambucil, thiopeta, and vincristine were used in high doses that could increase the risk of resistance or the normal cell to die (Rahmawati et al., 2013; Mahfur, 2016).

The current research encourages the development of novelty anticancer drugs with minimal side effects (Ala et al., 2018). The valuable research has been focused on new drugs that come from natural plant, particularly on herbs that have been trusted or used for generations (Garbi et al., 2015; Senthilraja and Katisheesan, 2015; Antoney et al., 2016). One of them is Sphagneticola trilobata (L.) J.F Pruski (Husain and Kumar, 2017).

Sphagneticola trilobata (L.) J.F Pruski with the familiar name Wedelia trilobata is a herbaceous plant of the Asteraceae family that has been believed to treat various diseases including gastritis, inflammation, varicose veins, skin diseases, headaches, healing (Gowri et al., 2014), and epilepsy (Mishra et al., 2011). In addition, some kinds of literature mentioned that the Asteraceae family had been used for the treatment of kidney disease, colds, respiratory diseases/bronchitis, snakebite, stomach ache, amenorrhea and dysmenorrhoea and fertility enhancers (Taddei, dan Rosas-Romero, 1999; Mardina et al., 2019). Balekar et al. (2014) stated that this type of plant could cure hepatitis, restore digestion and infection. It contains secondary metabolites which have antibacterial, antifungal, anti-plasmodium, anti-diabetic, hepatoprotective, antipyretic-analgesic and antitumor properties (Balekar et al., 2014; Chethan et al., 2012; Shankar dan Thomas, 2014; Verma dan Khasa, 2015).

The research about S. trilobata as an anti-cancer agent is undeveloped in Indonesia, even though the available resources are very abundant predominantly in the Aceh region and its surroundings. Moreover, the geographical condition of this nation is very supportive of the spread of this plant. International research on S. trilobata is still limited to the potential of anticancer agents (Balekar et al., 2014). Further research on the utility of S. trilobata as a phytomedicine in terms of phytochemicals and pharmacology requires special studies that must be proven,
specifically for the cases of breast cancer (Richard et al., 2015). Thomy dan Ginting (2011) have confirmed the potential of *Wedelia biflora* as an anti-cancer agent using the BSLT (Brim Shrimp Lethal Test) method. Kour (2014) reviewed potential plants as anti-cancer; one of them is *Wedelia chinensis* (Osbeck) Merr. Tsai et al. (2009) reported that *Wedelia chinensis* had cytotoxicity activity in prostate cancer cells (LNCaP / PC-3 / 22Rv1). Manjamalai and Grace (2013) have proven that oil extracts from *Wedelia chinensis* (Osbeck) had a chemotherapy effect on cases of lung cancer/lung cancer cells (C57BL / 6). Mardina et al. (2019) reported that *S. trilobata* has potential as a chemopreventive agent for tumors/breast cancer as evidenced by in vivo tests on mice.

The utility of sernai plants (*S. trilobata*) for traditional medicine had reported as the empirical evidence of the community without certain research/information (Rahardhian and Utami, 2018). Thus, further research on the special effects of the *S. trilobata* plant is required. The objective of this study to evaluate the in vitro anticancer of n-hexane extract from *S. trilobata* leaves in term of cytotoxic and specific anti-proliferation of MCF-7 breast cancer cells.

**Materials and Methods**

**Identification and Extraction of Sample**

The main sample used in this study was the leaves of *S. trilobata* (L) J.F. Pruski which collected from the Langsa city, Aceh. Sample identification was carried out at Medanense Herbarium, Universitas Sumatra Utara, Indonesia. Samples were dried for ± 7-10 days and cut into small pieces (±0.3 cm). Samples were macerated using n-hexane for 3x24 hours with three repetitions. Each repetition was filtered with *Whatman* filter paper No.1. The maceration extract was concentrated using a rotary vacuum evaporator.

**Preparation of the Extract for MTT Assay**

The n-hexane extract as a sample test was prepared with a concentration of 1000; 500; 200; 100; 50; 25; 10; 5 and 1µg/mL that was dissolved in RPMI 1640 media. Each concentration series was performed in triplicates.

**Preparation of MCF-7 Breast Cancer Cells**

MCF-7 cells were obtained from the American Type Culture Collection (ATCC HTB 22) and culture in the Primate Research Centre, Bogor Agricultural University. Roswell Park Memorial Institute (RPMI) 1640 is the main medium used with the supplement of 10% Fetal Bovine Serum (FBS), penicillin 100 U/mL, dan streptomycin 25 µg/mL. Cells were incubated up to 80% confluent at 37°C with a flow of 5% CO₂. Harvesting of cells (80% confluent) was characterized by tissue culture pumpkin filled. The number of cells was calculated using a haemocytometer under a microscope with the following formula: (Rahardhian dan Utami, 2018).
The percentage of inhibition was determined based on the following equation 1:

\[
Number\ of\ cells = \frac{Number\ of\ cells\ in\ 4\ chambers}{4} \times 10,000\ cells/ml
\]

Cytotoxicity Test

The MTT method was used in this cytotoxicity test. A total of 100 µL of MCF-7 cell suspension (5x10^4 cells / ml) were distributed into 96 microplate wells, then 100 µl of the test preparation solution was set with a predetermined concentration (1000; 500; 100; 50; 25; 10; 5 and 1 µg / mL). After incubation for 24 h at 37°C, MTT reagent was added to the cell suspension and then reincubated for 4 h. 10% SDS solution in 0.01 N HCl was given immediately as a stopper reagent and re-incubated for 24 hours at room temperature. Living cells would react with MTT to form formazan salt and were marked in purple. Absorbance readings were performed at a wavelength of 595 nm (Garbi et al., 2015).

Data Analysis

The data of cytotoxic test were analyzed in order to calculate LC₅₀ (Lethal Concentration that caused the 50% of MCF-7 cancer cells tested was die) by performing a linear regression equation of log concentration versus probit % mortality. The percentage of cell death is calculated by the following formula: (Rahardhian and Utami, 2018).

\[
Inhibition = \left( \frac{\sum_{\text{living cells in control}} - \sum_{\text{living cells in test compound}}}{\sum_{\text{living cells in control}}} \right) \times 100 \]

Results and Discussion

Sample in this study was identified in the Herbarium Medanense, Universitas Sumatera Utara, Indonesia with the number specimen of 4542/MEDA/2019. The result concluded the sample classification is as follow:

- Kindom: Plantae
- Divisi: Spermatophyta
- Kelas: Dicotyledoneae
- Ordo: Asterales
- Family: Asteraceae
- Genus: Sphagneticola
- Species: Sphagneticola trilobata (L.) J.F Pruski

Samples were dried for 7-10 days and cut into small pieces (±0.3 cm) and macerated with n-hexane, then evaporated to obtain the viscous extract. In vitro cytotoxicity test of the sample was carried out against MCF-7 breast cancer cells with a density of 5x10^4 cell/mL. MTT assay was chosen in the cytotoxicity test.
due to several advantages, namely rapid, simple, inexpensive and recognized as the qualitative method (Arisanty, 2013) to measure growth, survival and cell proliferation (Antoney et al., 2016).

The calorimetry test using 3-4,5-dimethylthiazol2-yl-2,5-diphenyl tetrazolium bromide (MTT) was first introduced by Mossman to promote the viability of mammalian cells. Cells that react with the help of the dehydrogenase enzyme convert the tetrazolium salt in yellow MTT into insoluble formazan (Figure 1). MTT testing is based on the principle that the amount of formazan produced is directly proportional to the number of living cells (Abate et al., 1998). Figure 2 showed the formazan crystals under a microscope. The concentration of formazan formed was measured using ELISA reader (multiwell scanning spectrophotometer) at a measured wavelength of 595 nm and calculated as the amount of optical absorbance/density. The greater the absorbance value obtained (the higher purple intensity) reflected an increase in cell viability. Thus it can be used to calculate the acquisition of death (Antoney et al., 2016).

![Figure 1. Redox reaction of MTT form to formazan crystal (Wyllie et al., 1980)](image1.png)

![Figure 2. One field of view on the calculation of the number of cells using a haemocytometer (A), formazan crystals seen from a microscope (B) with a magnification of 100x (a) living cells (b) dead cells, tetrazolium solution turns into insoluble purple formazan (C).](image2.png)
Table 1. The cytotoxicity test of n-hexane extract of semai leaves (S.trilobata) against MCF-7 breast cancer cells

<table>
<thead>
<tr>
<th>Concentration (µg/mL)</th>
<th>Log Concentration</th>
<th>% Mortality</th>
<th>Average of % mortality</th>
<th>Probit</th>
<th>LC₅₀</th>
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<td></td>
<td></td>
<td>Rep I</td>
<td>Rep II</td>
<td>Rep III</td>
<td></td>
</tr>
<tr>
<td>1000</td>
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<tr>
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<tr>
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<td>0</td>
<td>2.92</td>
<td>-0.85</td>
<td>10.22</td>
<td>4.10</td>
</tr>
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</table>

The test results in Table 1 exhibited the treatment of n-hexane extract could induce MCF-7 cell death. The higher concentration of n-hexane extract from *S.trilobata* toward MCF-7 cells would produce a greater mortality percentage of MCF-7. This might be influenced by the presence of secondary metabolites in *S. trilobata* extract as explained by Ahmed *et al.* (2019) that *Wedelia trilobata* (L.) Hitchc, consisting of 3α-tigloyloxypterokaurene L3, ent-17-hydroxy-kaura-9 (11), 15-dien-19-oic acid, wedelobotins A and wedelobotins B which have toxic effects on cancer cells. Research Venkatesh *et al.* (2016) found that methanol extract of *Wedelia trilobata* was toxic to MEG-01 cancer cells with an LC₅₀ value of 80 µg / mL for 48 hours incubation.

![Figure 3](image)

**Figure 3.** The relation graph between concentration logs of n-hexane extract from *S.trilobata* leaves versus probit of mortality percentage for calculation of LC₅₀ value.

Based on the graph in Figure 2, it could be calculated the LC₅₀ which levels cause the death of 50% of MCF-7 cells using probit analysis method. The regression equation obtained was \( y = 15.593x + 27.34 \) with the r-value of 0.8697. The LC₅₀ was obtained by substituting probit 5 into the linear equation. Then the x was obtained. Antilog of x was LC₅₀. The LC₅₀ calculation results obtained were
0.037 μg/mL. This means that at the level of 0.037 μg/mL of n-hexane extract from *S. trilobata* leaves could cause breast cancer cell death (MCF-7) by 50% of the number of cells tried. The smaller the concentration required to kill 50% of the viability cells means compound in the sample was more toxic.

**Conclusions**

The sample used in this study was *Sphagnicola trilobata* (L.) J.F Pruski which was macerated with n-hexane. In vitro cytotoxicity assay of crude extract was conducted on MCF-7 breast cancer cells with an LC50 value of 0.037 μg/mL.

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**References**


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