

Description of nelumbo nucifera biology essay

[Science](#), [Biology](#)



CHAPTER 2

Lotus, known by the scientific name *Nelumbo nucifera*, is an aquatic herb with submerged horizontal stems. The leaves have long stalks that join the leaf in the center of the blade and the leaf blade either floats on the surface or emerges above the water. The veins diverge from the center, splitting into two as they progress towards the leaf margin. The flowers emerge above the waterline and are diurnal, opening for two days and closing overnight. The flowers contain 2-6 white outer sepals and 10-30 spirally arranged white, pink, or red petals. When the flowers open, a large number of yellow stamens, the pollen producing structures, can be seen. The base of the lotus flowers, known as the receptacle (seed pod), expands and becomes fleshy during maturation and surrounds the ovary of the flower, which is made of many distinct compartments. An apical pore releases a single seed from each of these compartments within the dry flat-topped fruit. The brown seeds are hard-shelled and are 0.8 cm long. *Nelumbo nucifera*, is native to eastern Asia. This species has been cultivated since ancient times therefore its native distribution, prior to human influence, is difficult to determine though it may have extended to Australia and west to India. Lotus plants grow easily in waterlogged and inundated habitats. The rhizomes allow the plants to spread easily and are difficult to remove once they are established.

(Staples and Herbst, 2005). Table 2. 1 Taxonomy of lotus plant. Taxonomy of Lotus

PlantKingdomPlantaeSubkingdomTracheobiontaSubdivisionSpermatophytaDivisionMagnoliophytaClassMagnoliidaeOrderProtealesFamilyNelumbonaceaeGenus*Nelumbo* Adans. Species*nucifera* Gaertn

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com/Pictures/Landscape%20Plants/Shrubs/Web%20Pictures1/N/Nelumbo%20Nucifera. jpg

Figure 2. 1: Nelumbo nucifera plant.

2. 2 Measuring total phenolic content using Folin-Ciocalteu method

Phenolic compounds from plants are the natural antioxidant but the activity of it is lower than the synthetic antioxidant (Pattanayak, et al., 2011). Folin-Ciocalteu (FC) assay is a quantitative assay, easy, reproducible and often applies in the routine of quality control and to measure the antioxidant capacity of food products as well as dietary supplements (Ainsworth and Gillespie, 2007). FC assay involves the spectroscopic determination of blue complexes which result from the transfer of electrons in alkaline medium from phenolic compound to phosphomolybdic or phosphotungstic acid complexes (Ainsworth and Gillespie, 2007) using specific wavelengths to determine polyphenols present in tea (Dunja, et al., 2008).

2. 3 DPPH model system

2, 2-diphenyl-1-picrylhydrazyl (DPPH) is a stable free radical in methanolic solution (Marxen et al., 2007). The stability exhibited by DPPH is due to the delocalization of the unpaired electron over the molecule that prevents the molecule from undergoing dimerisation with one another like other free radicals (Molyneux, 2004). DPPH free radicals are often used in antioxidant activity evaluation of natural metabolites present in plant extracts because these metabolites are able to transfer the labile hydrogen atom to the DPPH radicals, which represents the most common and simple mechanism of antioxidant action (Kostic, Velickovic, Mitic, Mitic and Randelovic, 2012).

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DPPH. PNGFigure 2. 2: Free radical and non-radical form of DPPH (Molyneux, 2004)The free radical form of DPPH has a deep violet colour with maximum absorption at 517nm as long as the lone electron in the molecule remains unpaired. The violet colour will be lost in the presence of a hydrogen donating substance and turn into pale yellow. The extent of the decolorization of the violet colour is proportional to the radical-scavenging activity of the tested substance.

2. 4 Antimicrobial susceptibility testing (AST) using broth microdilution method

The efficacy of potentials antimicrobial agents from plant extracts against various microbial species is often screened using antimicrobial susceptibility test (AST) (Ncube, Afolayan and Okoh, 2008). AST can be easily categorized into diffusion methods, such as agar well diffusion, agar disk diffusion and bioautography, and dilution methods, such as agar dilution and broth macro/microdilution. The criteria used to evaluate the performance of a susceptibility test are reproducibility, ease of use and the ability to yield the same results on subsequent testing, test sensitivity and specificity (Struelens et al, 1995). The micro-titre plate or broth microdilution method is a useful technique for determining minimum inhibitory concentrations (MICs). This method can be used for a wide variety of microorganisms, not expensive and reproducible (Ncube, Afolayan and Okoh, 2008). Besides that, microbroth dilution method has several advantages over diffusion techniques. These include increased sensitivity for small quantities of extract, which is crucial because most natural products possess limited amount of antimicrobials, ease of distinguishing between bacteriostatic and bactericidal and

quantitative evaluation of MIC (Langfield et al., 2004). The presence of growth of microorganisms in the microtitre plates can be determined either with turbidometry, spectrophotometry or calorimetric indicator. The usage of dye as an indicator can avoid the uncertainties linked to visual comparison or measurement of growth inhibition and eliminate the need of a spectrophotometric plate reader (Ncube, Afolayan and Okoh, 2008). One of the common calorimetric indicator is 2-(p-iodophenyl)-3-(p-nitrophenyl)-5-phenyltetrazoliumchloride (INT). INT appear as a colourless solution but is able to be reduced into a pink colour formazan when it accepts electrons from the dehydrogenase enzyme of bacteria. This phenomenon happens only when bacteria undergo cellular respiration process, which signifies growth. <http://ars.els-cdn.com/content/image/1-s2.0-S0300483X12001680-gr1.jpg> Figure 2. 2: Schematic representation of the reduction of INT in the presence of cellular respiration (Wang et al., 2012).

2. 2 Phytochemistry and Pharmacology

Numerous previous studies have shown that almost every part of lotus exhibited a wide spectrum of pharmacological activities. Lotus seed extract has been demonstrated to possess hepatoprotective, free radical-scavenging properties and antifertility properties (Sohn et al., 2003). The water, ethyl acetate, hexane extracts of lotus seed showed dose-dependent inhibitory effect on the accumulation of nitric oxide upon the decomposition of sodium nitroprusside in liposaccharide-activated RAW 264. 7, a macrophage cell line. In 2004, Liu et al. has reported that ethanolic extracts of lotus inhibit cell proliferation and cytokines in primary human peripheral blood mononuclear cells, which suggest an anti-cancerous effect. Extracts from one of the

inedible parts of lotus, the seed epicarp, was found to possess very strong antioxidant effects in relation with high levels of total flavonol content. The work of Shad, Yaqoob and Yousuf, 2012 has revealed that the rhizomes contain a considerable amount of phytochemicals such as tannins, saponins and phenolic acids.