Guest Articles

Phytochemicals in Sri Lankan Curry Powder

K. Sarath D. Perera and A. D. Theeshya Dulmini

Department of Chemistry, The Open University of Sri Lanka

Nowadays people feel the need to enhance their immunity by consuming various nutritional food and beverages. From ancient times, Asian women have been using spices, not only to boost the taste and aroma, but also to add medicinal value to their cuisines. However, the types of spices, the mixing ratios, and the process of incorporating them to the dish, varies across regions and countries.

Sri Lankan housewives use unroasted yellowish colored curry powder to prepare mild vegetable dishes, and roasted dark brown colored curry powder to add an intense taste to dishes such as fish, meat and green jack fruit etc. The number of spice-ingredients in the roasted curry powder is usually higher than in the unroasted powder and dishes prepared using the former have a longer shelf-life.

Traditional Sri Lankan curry powder is known as "Thuna Paha". Literally, "Thuna and Paha" means 3 and 5 in English, respectively. It depicts a combination of 8 spices. But according to Sri Lankan ayurvedic medicinal texts, the original curry powder was composed of more than 40 spices. The recipe of the "Thuna Paha" mixture has been passed down from generation to generation (mother to daughter); hence, the composition of the mixture could change with the personal preferences and the availability the ingredients.

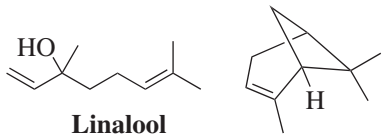
Every Sri Lankan curry powder mixture consists of coriander, cumin and fennel as the three key ingredients, and the rest of the ingredients are selected from cloves, fenugreek seeds, cinnamon, curry leaves, mustard seeds, pepper and chillies.

Chemical constituents of curry powder

First, we will consider the chemical constituents of the three main spices.

Coriander seeds ("*Koththamalli*")

The pungent, citrus-flavored, round shaped seeds of *Coriandrum sativum* are dried and well-grounded to make curry powder. Linalool is the main phytochemical present in these seeds. Other compounds that can be found in coriander seeds are γ-terpinene, α-pinene, *p*-cymene and camphor. Antioxidant, antifungal and antibacterial properties of coriander are important as it increases the shelf-life of the curry powder mixture.

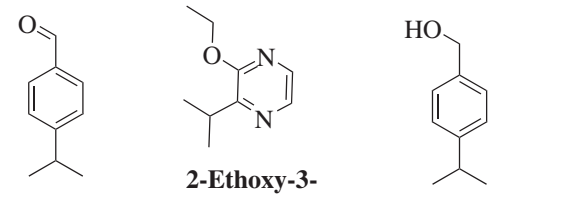


Linalool **α-Pinene**

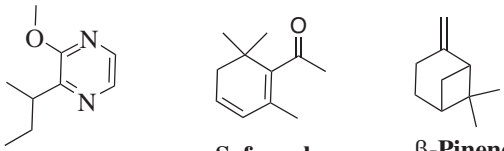
γ-Terpinene **p-Cymene** **Camphor**

Cumin seeds ("*Sooduru*")

Rod-shaped cumin (*Cuminum cyminum*) seeds have a distinctive strong flavor. Cuminaldehyde and cuminic alcohol (cuminyl alcohol) give a unique aroma to these seeds. γ-terpinene, safranal, *p*-cymene, and β-pinene and substituted pyrazines such as 2-ethoxy-3-isopropylpyrazine, 2-methoxy-3-sec-butylpyrazine, 2-methoxy-3-methyl pyrazine, and vitamins B and E are the other compounds present in cumin seeds.



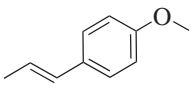
Cuminaldehyde **2-Ethoxy-3-isopropylpyrazine** **Cuminyl alcohol**



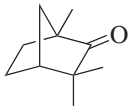
3-sec-Butyl-2-methoxypyrazine **Safranal** **β-Pinene**

Fennel seeds ("*Mahaduru*")

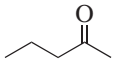
Fennel seeds consists of dried, ripe fruits of F*oenicum vulgare* and they are larger than Cumin seeds. 4-Methoxy benzaldehyde, fenchone, *trans*-anethole and 2-pentanone are the major compounds that are present in fennel seeds.



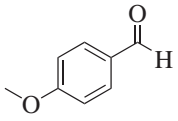
***trans*-Anethole**



Fenchone



2-Pentanone

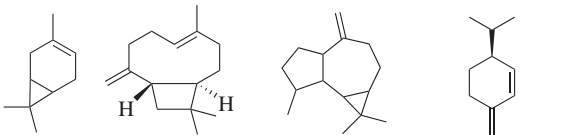


4-Methoxybenzaldehyde

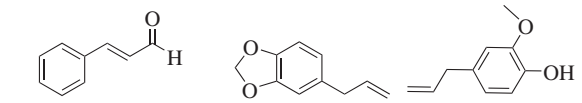
Other spices

Some of the following spices are used in both roasted and unroasted curry powder mixtures.

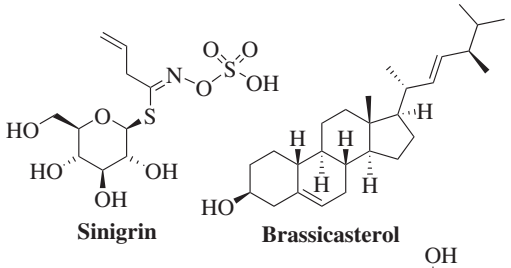
Spice	Edible part	Chemical constituents
Curry leaves	Leaves of *Murraya koenigii*	3-carene, β-pinene, β-caryophyllene, α-pinene, β-phellandrene, aromadendrene
Ceylon Cinnamon	Bark of *Cinnamomum zeylanicum*	*trans*-cinnamaldehyde, eugenol, safrole, cumin aldehyde, linalool
Mustard	Seeds of *Brassica juncea*	sinigrin, progoitrin, brassicasterol, campesterol, alinolenic acid
Cloves	Nuts of *Syzygium aromaticum*	eugenol, eugenol acetate, limonin, ferulic aldehyde, quercetin
Cardamom	Capsules of *Elettaria cardamomum*	1,8-cineole, α-terpinyl acetate, limonene, linalool
Pepper	Seeds of *Piper nigrum*	α- and β-pinene, myrcene, α-phellandrene, 2-isopropyl-3-methoxypyrazine
Chilies	Pods of *Capsicum frutescens*	9,12-octadecadienoic acid (Z,Z), 3-carene, palmitic acid, eicosane



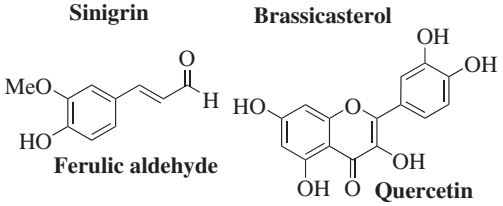
3-Carene **β-Caryophyllene** **Aromadendrene** **β-Phellandrene**



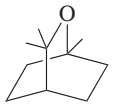
***trans*-Cinnamaldehyde** **Safrole** **Eugenol**



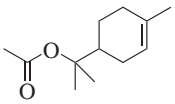
Sinigrin **Brassicasterol**



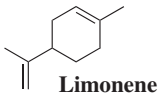
Ferulic aldehyde **Quercetin**



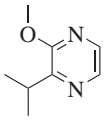
1,8-Cineole/eucalyptol



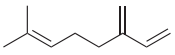
α-Terpinyl acetate



Limonene



2-Isopropyl-3-methoxypyrazine



Myrcene

Health benefits of curry powder

Almost all the spices in our curry powder mixture exhibit antioxidant, antimicrobial, and anti-inflammatory properties as they contain a large amount of phenolic and flavonoid compounds. Antioxidants are important to counter free radicals which can damage the living cells. Cumin, cinnamon, cardamom and clove show cardioprotective properties; especially 1,8-cineole in cardamom clears the bad breath by killing bacteria in the breathing passage. This phytochemical inherits hepatoprotective and anticarcinogenic properties. The use of cinnamon, fennel, and cumin is used in traditional medicines to cure diabetes as well. Neuroprotective properties of curry powder are mainly due to the presence of cumin, fennel, and cardamom. The phytochemicals in mustard, cinnamon, curry leaves, cloves, and cumin are important to decrease the

low-density cholesterol level in the body. Curry powder is a good medicine to maintain a proper digestive system. Sometimes, consumption of roasted curry powder in excessive amounts can cause gastritis.

Recently, scientists have discovered that curry powder is a good treatment for respiratory diseases related to particulate matter, with aerodynamic diameters less than 2.5 micrometers. These particles are generated by combusting fossil fuels and their higher penetrating ability enhances the health risk as they can circulate through the bloodstream.

Iron is a crucial element to our body. It is essential for the production of hemoglobin which carries oxygen in the blood. Some researchers have proved that curry powder acts as a suitable vehicle to transport iron in the body. They suggest that the addition of NaFeEDTA to curry powder is the most convenient way to increase the iron content, as this mixture of spices is being consumed regularly.

However, there are a lot of forfeited and adulterated curry powder mixtures in the market. They can cause diseases, instead of providing health benefits. For better health benefits, it is always advisable to prepare the curry powder mixture at your home with fresh ingredients. It will give a pleasent taste to your food as well as a healthy life.

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Professor K Sarath D Perera *obtained his BSc from University of Sri Jayewardenepura and completed his PhD in Queen's University Belfast, UK. He is currently serving as a Senior Professor at the Department of Chemistry, Open University of Sri Lanka.*

Ms. A. D. Theeshya Dulmini *graduated from the Open University of Sri Lanka and obtained her MSc. in Analytical Chemistry from the University of Colombo.*

Guest Articles

Neglected Treasure for a Better Future

Charitha Jayaruk

Faculty of Humanities and Sciences, Sri Lanka Institute of Information Technology

Living in Sri Lanka has become a question to many Sri Lankans today due to the hardest economic crisis that we as a country are facing currently. It is hard to balance the terms of each requirement including the main needs, food, and medicine. Therefore, to facilitate the quality of living people leaves the country. Let's stop and look back at ourselves. Have we done our duty for the country? Sri Lanka the pearl of the Indian ocean attracted many foreign invaders including Portuguese, Dutch, and Great Britain due to the treasure inherited by the country. However, after the independence, have we valued our tressure, and the answer is probably not. In this article, it is intended to discuss such neglected treasure from a chemist's point of view.

Minerals

Ilmenite and rutile, the black sand available in coastal regions of Sri Lanka in the areas of Pulmodai, Induwara, Kokkulai, Kokkuthoduvai, Nayaru, Muhathuvaram, and Chemmalai *etc*. are being exposed to other countries such as Australia, China, India e as the main way of earning foreign exchange. Ilmenite and rutile are the main raw material to synthesize pure TiO_2, the white colour pigment being used worldwide for many industries including paper, paint, plastic, coating, food and cosmetics and pharmaceuticals as well[1]. Isolating pure TiO_2 from ilmenite mainly involves chemical treatment in which mostly hazardous chemicals like hydrochloric acid, sulfuric acid, phosphoric acid, ammonium hydroxide, and sodium hydroxide are being used. The lack of such facilities to handle these chemicals and their waste have led to the export of the minerals as it is to other countries without any value addition. However, researchers have concentrated their researches'only on obtaining pure TiO_2 neglecting the acid leachate as the waste product. A value has been added to the whole process where new binary and ternary nanocomposites including Fe_2TiO_5/TiO_2, Fe_2O_3/ Fe_2TiO_5/TiO_2, Fe_2O_3/TiO_2, Fe_3O_4/TiO_2 have been fabricated using the acid leachate[2–4]. Further, novel nanocomposites have been developed using sucrose as the carbon source with the product obtained from neutralizing acid leachate.

Iron present in the product catalytically graphitized the sucrose forming TiO_2-Fe_3C-Fe-Fe_3O_4/graphitic carbon composite[5]. Similarly, chitosan extracted from shrimp shells was mixed with the same ilmenite product and produced Fe_2O_3-TiO_2/N enriched graphitic carbon. These nanocomposites have shown excellent photocatalytic activities in degrading methylene blue under sunlight and visible light. Dyes in wastewater cause severe health effects to all living beings and additionally they prevent light penetration through the water body limiting the photosynthesis by aquatic plants. Further, as they persist in the ecosystem because they are not readily degradable and therefore, they degrade the aesthetic value of the water bodies and increase biological and chemical oxygen demand. Therefore, the removal of dyes is essential. Among the already existing methods for removal of adsorption, filtration, coagulation, and oxidation advanced oxidation process are more prominent as it degrades the dye molecules into harmless products.