



Research for Industry

*Selected abstracts
from the JNSF
September & December
2023 Issues*

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Recognizing the benefit to the industry our flyer presents selected abstracts of the articles published in the Journal of the National Science Foundation September & December 2023 issue.

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pH-dependent release properties of curcumin encapsulated alginate nanoparticles in skin and artificial sweat

Cosmeceutics

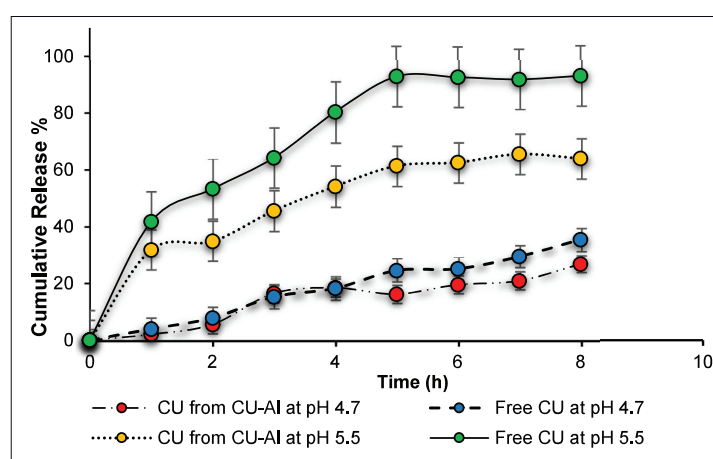
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DOI: <http://dx.doi.org/10.4038/jnsfsr.v51i3.11221>

Abstract

Topical skin application of curcumin is challenging due to the low solubility and poor stability, including fast photodegradation, of this bioactive compound. Therefore, curcumin encapsulated alginate (CU-AI) nanoparticles were prepared by the ionic gelation method followed by freeze drying to determine the efficacy of alginate in facilitating curcumin release. Evaluation of the release of curcumin from the encapsulate in the presence of artificial sweat (pH 4.7) and skin (pH 5.5), about which the literature is meagre, was carried out after particle size characterization. CU-AI nanoparticles were in the nano-range (186.8 nm), assimilated a negative zeta-potential value (-15.4 ± 8.13 mV), and displayed a high encapsulation efficiency ($94.55 \pm 0.53\%$). The release of encapsulated curcumin at pH 5.5 (max. 64%) and at pH 4.7 (max. 27%) were significantly different. In pH 5.5 and pH 4.7, the release profiles of encapsulated curcumin fitted best with the Weibull (followed an anomalous transport mechanism) and Gompertz (followed a super case II transport mechanism) models respectively, displaying sigmoidal release patterns. Diffusion and polymer relaxation/swelling based release at pH 5.5 and rapid polymer relaxation/erosion based release at pH 4.7 have governed the encapsulated curcumin release. The results indicated that CU-AI nanoparticles may be utilized to facilitate controlled and prolonged release of curcumin in both skin and artificial sweat, thereby functioning as a promising novel delivery vehicle for curcumin. However, skin deposition or penetration may be required for yielding a satisfactory topical administration of curcumin during sweating.



Release of free CU and CU from CU-AI nanoparticles at pH 5.5 and artificial sweat pH 4.7 (CU – free curcumin, CU-AI – Curcumin encapsulated alginate particles)

Link: <https://www.nsf.gov.lk/index.php/component/content/article/20-home/471-jnsf-volume-51-no-3-september-2023?Itemid=101>

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Secure CodeCity: 3-dimensional visualization of software security facets

Software Engineering

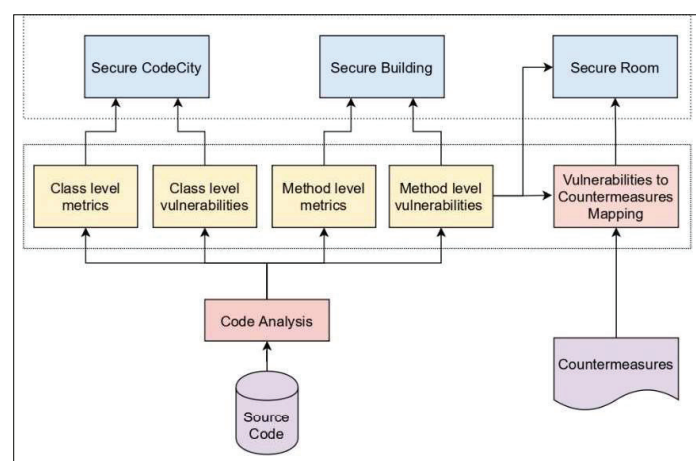
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Abstract

Over the last few decades, the software industry investigated security best practices to guide software developers in producing less vulnerable software products. As a result, security engineering has emerged as an integral part of the software development lifecycle. With the increase in the number of security vulnerabilities discovered, the software industry encountered challenges finding software security experts. Despite the availability of static code analysis tools to detect security vulnerabilities, they are underused due to several reasons such as inadequate usability and the lack of integration support. For example, such tools are deficient in providing enough information, produce faulty warning messages, and miscommunicate with developers. As a solution, this work presents a conceptual framework and a proof-of-concept visualization tool, Secure CodeCity, as an extension to the CodeCity metaphor, to facilitate security analytics. Secure CodeCity extends the CodeCity metaphor into three different granularity levels in 3-dimensional space, facilitating the vulnerability analysis in different granularities. Thus, software practitioners can use Secure CodeCity to obtain useful security-related information such as 'What is the most vulnerable class/method in a particular software project?'. A between-subjects design-based user study was conducted with 23 subjects using a set of security-related tasks with two benchmark open-source Apache projects. The evaluation results show that Secure CodeCity surpasses the state-of-the-art security analysis tools in terms of correctness, usability, and time efficiency.



Architecture of visualization

Link: <https://www.nsf.gov.lk/index.php/component/content/article/20-home/471-jnsf-volume-51-no-3-september-2023?Itemid=101>

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Genetic control of fruit length, external colour and number of fruits per vine in bitter gourd studied using *Charantia* × *Muricata* crosses

Horticulture

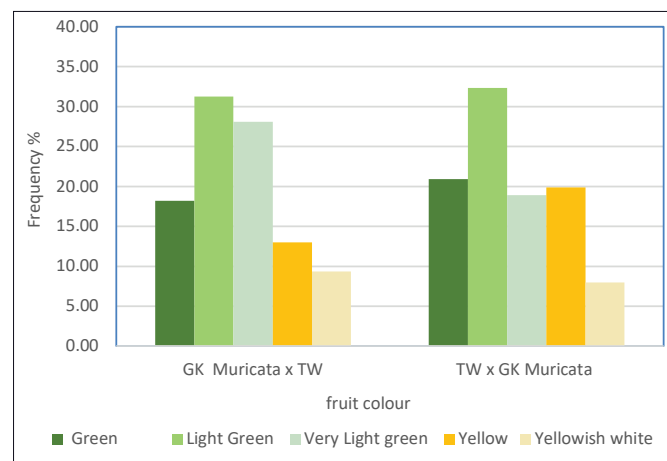
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Abstract

The present study was undertaken to ascertain the genetic control of external fruit colour, fruit length, and the number of fruits per vine in bitter gourd using reciprocal crosses of *Momordica charantia* var. *muricata* and *M. charantia* var. *charantia* and to identify suitable lines of *M. charantia* var. *muricata* to be used in bitter gourd improvement programmes. *Muricata* accession collected from Girandurukotte (GK), Sri Lanka, was selected as a suitable accession for crop improvement based on higher gynoecy and consistency of characteristics. Crossing success between *Charantia* and *Muricata* varieties was 100 % indicating cross-compatibility between the two types. External fruit colour, fruit length and the number of fruits per vine of bitter gourd were found to be quantitative traits, potentially controlled by many genes, each with a small effect. The number of fruits per vine was found to show cytoplasmic inheritance, as the F1 generation recorded fruit numbers per vine similar to those of *Charantia* varieties, when *Charantia* varieties were used as the female parent of the reciprocal crosses made between *Charantia* and *Muricata* varieties. However, the suspected cytoplasmic effect was not useful, as it influenced to reduce the number of fruits per vine. In addition, the number of fruits per vine showed several transgressive segregants in both extremes of the F2 populations. In bitter gourd improvement programmes, GK *Muricata* accession may be used to improve cultivated *Charantia* varieties with respect to fruit characteristics such as external fruit colour, fruit length and the number of fruits per vine through a breeding program with the directional selection made towards obtaining the desired characters.



Percentage distribution of external fruit colour in two F2 populations derived from the cross of GK *Muricata* accession × Thinnaweli White, and the reciprocal cross.

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Does an R2R3-MYB transcription factor affect *Anthurium* spathe colour variation via regulation of vacuolar pH?

Agricultural Biotechnology

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Abstract

The *Anthurium* is a popular cut flower worldwide having red, pink, coral, white, green, or brown spathes. There is a constant demand for new flower colours in the commercial market. Flower colour in plants is mainly determined by anthocyanins. Understanding anthocyanin variation and other factors affecting *Anthurium* spathe colour is important for genetic engineering approaches. Therefore, our objectives were to assess the factors affecting colour variation of selected commercially available cut flower *Anthuriums* and to determine the associated regulatory networks and transcription factors (TFs). Nineteen commercial cut flower *Anthurium* cultivars were selected for this purpose. The colour of the spathe surface, anthocyanin location, anthocyanidin type and vacuolar pH were recorded. Anthocyanin associated Gene Network Model generation and analysis were carried out. The CIELAB colourimeter procedure indicated the colour variation among the selected 19 cultivars in terms of colour type, colour intensity, chroma, and hue angle. The location of anthocyanin was limited to mesophyll and epidermal cells. Cyanidin was detected in tested *Anthurium* cultivars as the main anthocyanidin. The pH gradient in pigment extracts indicated a variation with a range of 4.6 to 4.94. The gene pathways of anthocyanin biosynthesis and transport were associated with that of the vacuolar pH/H⁺ pump according to Gene Network Model. Three pathways were regulated by an R2R3-MYB transcription factor. Although, cyanidin was the only pigment in all the tested cultivars, different pH levels by R2R3-MYB regulated V-H⁺ synthase was suggested to be the cause of the high colour variation in addition to the anthocyanidin type and location. Our results indicate the application of R2R3-MYB transcription factor genes for desirable vacuolar pH maintenance in genetic engineering of the blue *Anthurium* in the future.



The commercially available *Anthurium* cultivars collected from Japan for the pigment analysis. (a) Wind, (b) Paradise, (c) Okinawa, (d) Maxima, (e) Tulip Summer, (f) Sharren, (g) Maxima Erigancia, (h) Flabia, (i) Losa green

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