TWO IN ONE

Meeting the challenge of specificity and developing scientific communication skills

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TWO ESAP MODULES

English Language for Chemists

Homogeneous group

- all from Nanjing, China
- all upper B2
- all do same modules
- all Part 3 (final year UG)

10 credits / 1 term

Strong lexical element

English for [Food] Scientists

Heterogeneous group

- some from Henan, China / some from Thailand
- some upper B2 / some lower C1
- very few common modules
- Part 2 / Part 3

20 credits / 2 terms

Career development skills element

ISSUES TO OVERCOME

Students writing in their own words

Students communicating clearly

Students writing in a variety of genres

Students being aware of audience

Selecting topics that students can write about without needing a science lesson

English teachers understanding student writing

EMPATHY WRITING

“assignments that involve communicating disciplinary knowledge

in forms such as newspaper articles or information leaflets and

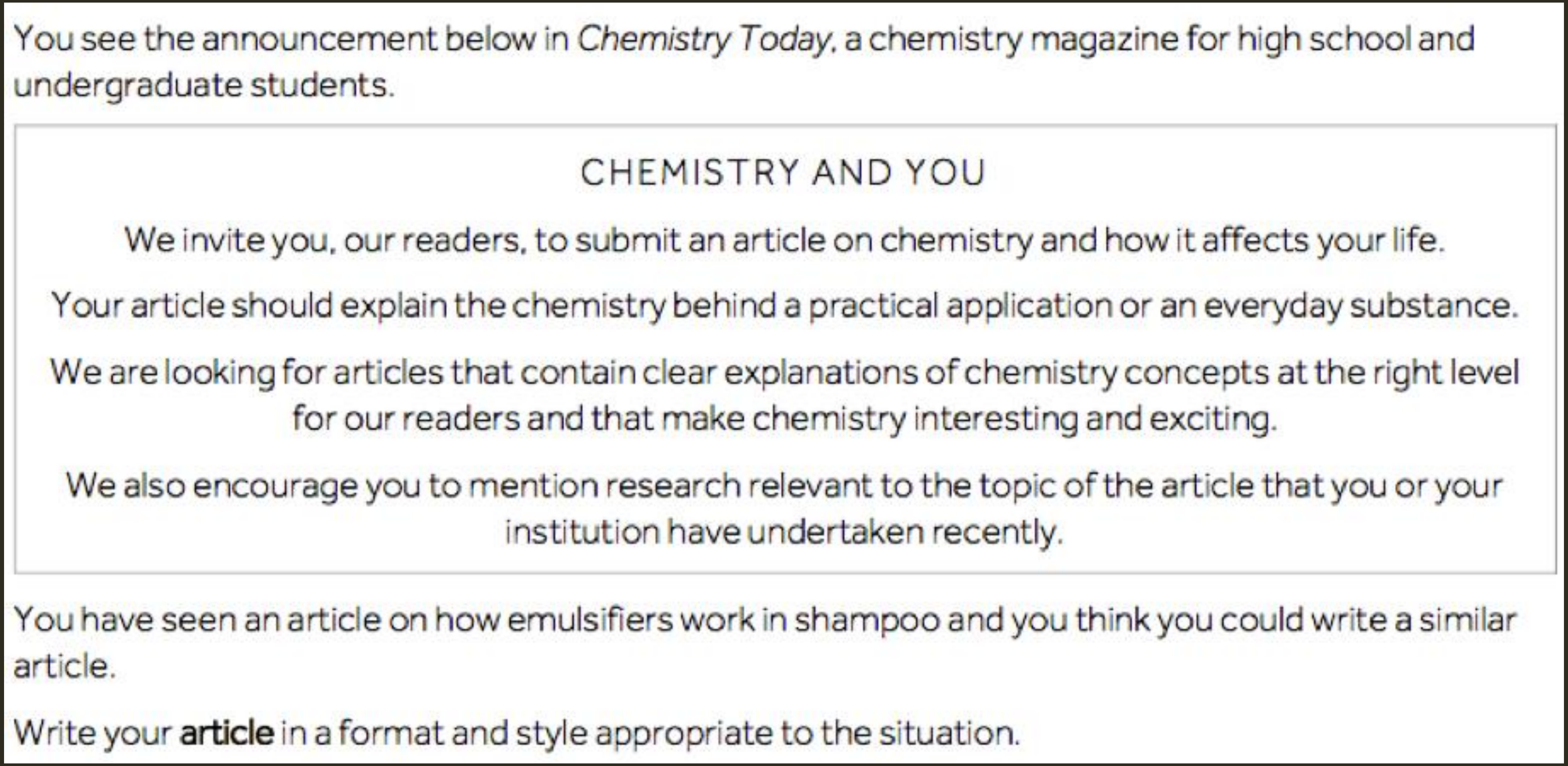
in registers suitable for ‘general’ audiences”

“they challenge writers

to understand disciplinary knowledge and

to express [disciplinary knowledge] using transferable, ‘non-academic’ writing skills … useful in the world of work”

(Nesi & Gardner, 2012, p. 42)



You see the announcement below in *Chemistry Today*, a chemistry magazine for high school and undergraduate students.

CHEMISTRY AND YOU

We invite you, our readers, to submit an article on chemistry and how it affects your life.

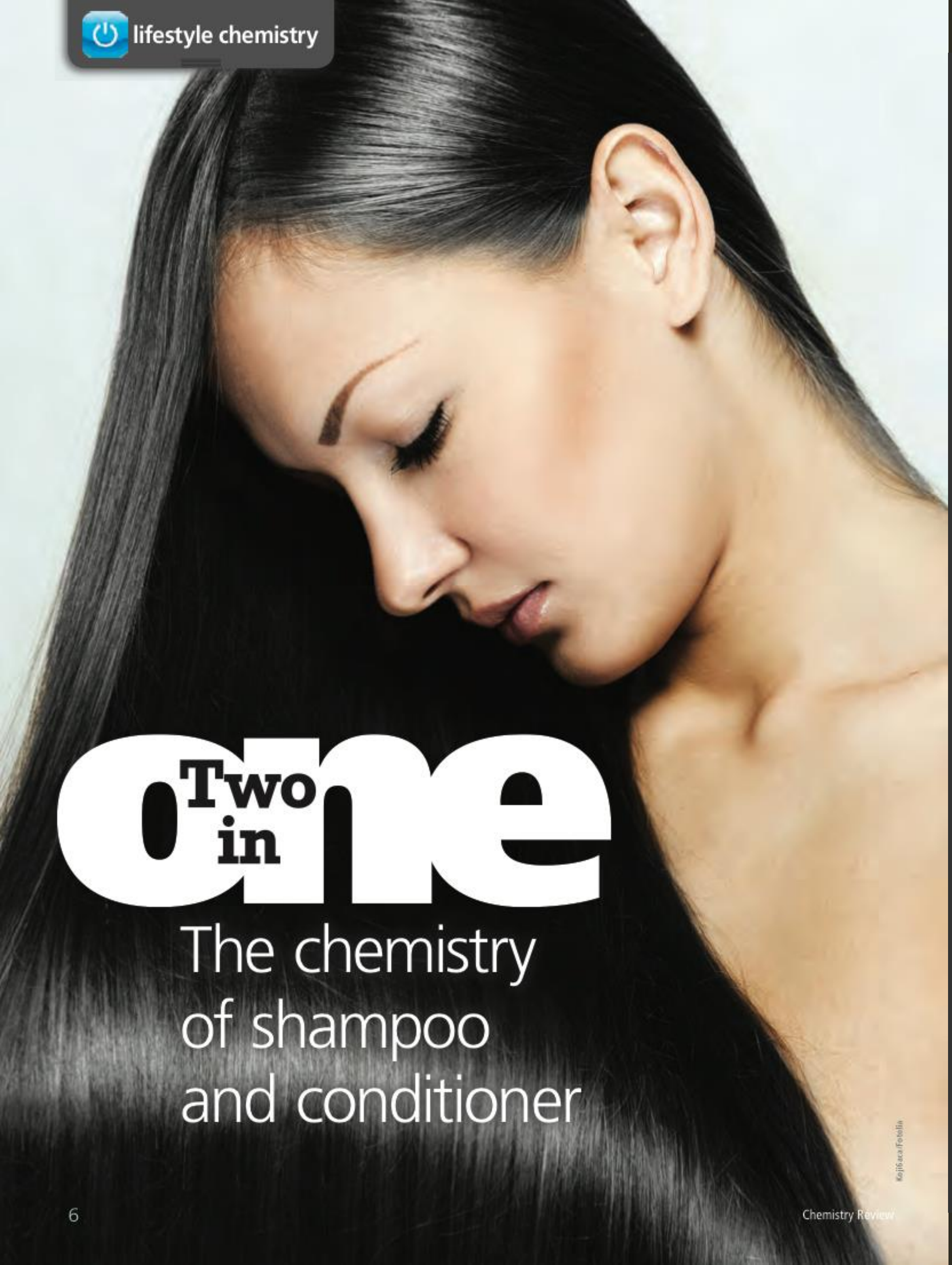
Your article should explain the chemistry behind a practical application or an everyday substance.

We are looking for articles that contain clear explanations of chemistry concepts at the right level for our readers and that make chemistry interesting and exciting.

We also encourage you to mention research relevant to the topic of the article that you or your institution have undertaken recently.

You have seen an article on how emulsifiers work in shampoo and you think you could write a similar article.

Write your **article** in a format and style appropriate to the situation.



Kojj6aca/Fotolia

Two in one

The chemistry of shampoo and conditioner

Exam links

The terms in red link to topics in the AQA, Edexcel, OCR, WJEC and CCEA A-level specifications, as well as the Highers/Advanced Highers exam specifications.
Understanding the chemistry behind hair-care products requires a knowledge of **surfactants, cations, anions** and **polymers**.

Some people spend a great deal of money on various bottled potions for their hair, and new products are constantly being released. It is a highly competitive market, with much money spent on celebrity endorsements and advertising campaigns. With brands having numerous different products, have you stopped to wonder what varied bits of chemistry they contain? This 'Lifestyle chemistry' explores some of the chemistry behind hair shampoos and conditioners, including how chemistry can help you to have lovely shiny hair.

What is hair?

The hair on your head is made up of three main layers (Figure 1):

- The outermost layer is the *cuticle*. The cuticle layer has scale-like structures that cover the hair's surface, protecting the hair strand as well as providing certain aesthetic properties, such as shine.
- The *cortex* lies beneath the cuticle layer and contains the pigments that provide the hair's colour.
- The layer running through the centre of the hair strand is known as the *medulla*.

All three layers are made up of protein-rich dead cells. Hair freshly emerging from the hair follicles, i.e. near the scalp, has had far less exposure to sources of physical or chemical damage, such as heat from blow-drying or hair dye. These processes can damage and weaken the cuticle layer, decreasing its quality as the hair proceeds from root to tip (Figure 2).

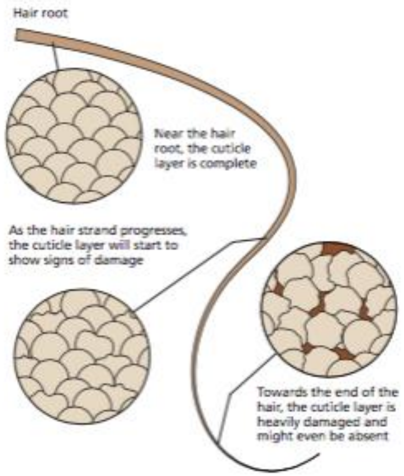


Figure 2 Schematic representation of how the quality of the cuticle layer deteriorates towards the end of the hair

The hair is coated in oil secreted by glands near to the hair follicle. This provides a degree of protection to the cuticle surface. This layer of oil is also good at absorbing a
and dirt it is exposed to, as well as compounds c
in styling products. This means that our hair needs
washing to keep it feeling and looking clean. The la
cannot be rinsed off with water due to its **hydrophob**
so shampoos are used to help clean your hair.

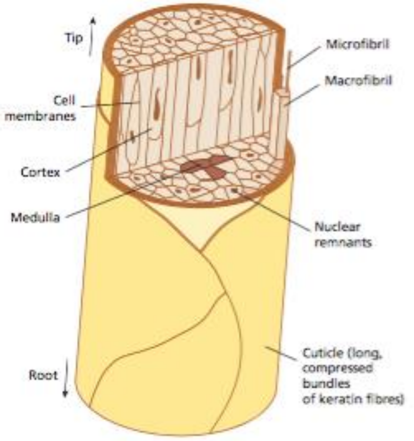


Figure 1 Structure of a human hair

Most modern shampoos use surfactants that do not originate from soap

Glossary

Emulsion A mixture of liquids that are normally immiscible
When forced to mix, one of the liquids will become dispersed
the other, but they do not properly mix. Surfactants can stabi
an emulsion, e.g. proteins act as surfactants to stabilise milk
emulsion of fat in water).

Hydrophilic 'Water loving'. A hydrophilic substance (e.g. s
typically polar and so mixes easily with water.

Hydrophobic 'Water hating'. A hydrophobic substance (e.
generally non-polar (in many cases having a long hydrocarbo
and will not mix with water.

Polymer A chain made out of many repeated units.

Quaternary amine A nitrogen atom with four substituen
bonded to it. It has a positive charge.

Surfactant The word surfactant is derived from the phrase
active agent. A surfactant can cause two immiscible liquids t
lowering the surface tension between the two.

Soaps and surfactants

The term 'shampoo' is believed to have originated from
India, where it referred to a head massage, often with
smelling oils. During the nineteenth century, the w
to mean the application of soap to the hair in order to

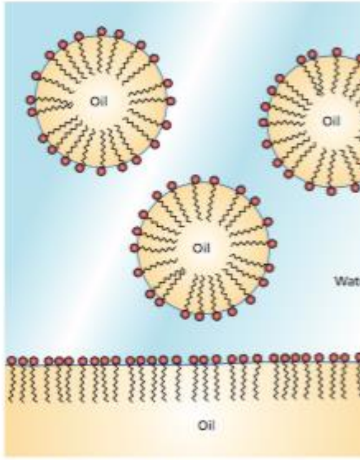


Figure 3 Surfactant molecules at an oil–water interface.
surfactant molecules arrange themselves with their hydro
head group in the water and their hydrophobic tail in the

Chemical Science

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EDGE ARTICLE

Bonding in homoleptic iron carbonyl cluster cations: a combined infrared photodissociation spectroscopic and theoretical study†

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Infrared spectra of mass-selected homoleptic iron carbonyl cluster cations including mononuclear $Fe(CO)_5^+$ and $Fe(CO)_6^+$, dinuclear $Fe_2(CO)_8^+$ and $Fe_2(CO)_9^+$, and trinuclear $Fe_3(CO)_{12}^+$ are measured *via* infrared photodissociation spectroscopy in the carbonyl stretching frequency region. The structures are established by comparison of the experimental spectra with simulated spectra derived from density functional calculations. Only one IR band is observed for the $Fe(CO)_5^+$ cation, which is predicted to have a C_{4v} structure. The $Fe(CO)_6^+$ cation is determined to be a weakly bound complex involving a $Fe(CO)_5^+$ core ion. In contrast to neutral clusters which have symmetric structures with two and three bridging carbonyl ligands, the dinuclear $Fe_2(CO)_8^+$ and $Fe_2(CO)_9^+$ cations are characterized to have unbridged asymmetric $(OC)_5Fe–Fe(CO)_n^+$ ($n = 3$ and 4) structures. The trinuclear $Fe_3(CO)_{12}^+$ cluster cation is determined to have an open chain like $(OC)_5Fe–Fe(CO)_2–Fe(CO)_5$ structure instead of the triangular structure with two bridging CO groups for the $Fe_3(CO)_{12}$ neutral. The di- and trinuclear cluster cations all involve a square pyramid like $Fe(CO)_5$ building block that satisfies the 18-electron configuration of this iron center. The $Fe(CO)_5$ building block is isolobal to the CH_3 fragment in hydrocarbon chemistry, the $Fe_2(CO)_9^+$ and $Fe_3(CO)_{12}^+$ cluster cations may be considered through isolobality to be metal carbonyl analogues of the ethyl and isopropyl cations.

Introduction

The structure and bonding of transition metal carbonyl clusters are central contents of modern coordination chemistry and cluster chemistry. Iron carbonyls have received particular attention due to their importance in catalytic and other reactions. $Fe(CO)_5$, $Fe_2(CO)_9$, and $Fe_3(CO)_{12}$ are well-known stable homoleptic iron carbonyls, which are widely used as starting materials in synthetic transition-metal organometallic chemistry. Coordinatively unsaturated iron carbonyl neutrals including mononuclear $Fe(CO)_x$ ($x = 1–4$), dinuclear Fe_2CO and $Fe_2(CO)_8$ and multinuclear $Fe_4(CO)_{14}$ have been prepared either *via* photodissociation of stable iron carbonyls or *via* reactions of iron atoms and clusters with CO, and were studied spectroscopically[1–10] and theoretically.[11–21]

Besides the neutral carbonyls, anionic iron carbonyls have also received considerable experimental and theoretical attention. Mononuclear iron carbonyl anions have been produced in noble gas matrices as well as in gas phase, which were studied using infrared and photoelectron spectroscopy and theoretical calculations.[5,6,22–27] Anionic iron carbonyl clusters are quite common in the condensed phase.[28] Species such as $Fe_2(CO)_8^-$ and $Fe_4(CO)_{13}^-$ occur in the condensed-phase chemistry of $Fe(CO)_5$.[29] The radical anion $Fe_3(CO)_{11}^-$ and the dianions $Fe_3(CO)_{11}^{2-}$ and $Fe_4(CO)_{13}^{2-}$ have been produced in the condensed phase as salts with counter cations and studied spectroscopically.[30,31] Infrared spectra of dinuclear and multinuclear iron carbonyl cluster anions were measured *via* infrared photodissociation spectroscopy in the gas phase.[32,33]

Compared to the neutrals and anions, the iron carbonyl cations have received much less attention. The mononuclear and dinuclear iron carbonyl cations have been formed by ion-molecule reactions in the gas phase and have been studied using mass spectrometry. The dissociation energies of the radical cations $Fe(CO)_n^+$ ($n = 1–5$) and $Fe_2(CO)_n^+$ ($n = 1–9$) were measured.[34–36] Although the structure and bonding of some mononuclear iron carbonyl cations were theoretically studied and some of them were investigated spectroscopically,[37,38] the electronic and geometric structures of gaseous iron carbonyl cluster cations are relatively unknown. In the present paper, mass selected homoleptic mononuclear and multinuclear iron carbonyl cluster cations are studied by infrared photodissociation spectroscopy. The cluster structures are assigned by comparison of the experimental spectra with simulated spectra derived from density functional calculations.

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† Electronic supplementary information (ESI) available: The vibrational frequencies and geometries (as Cartesian coordinates) of all calculated structures. See DOI: 10.1039/c2sc20947k

Experimental and computational methods

The infrared photodissociation spectra of the homoleptic iron carbonyl cations were measured using a collinear tandem time-of-flight mass spectrometer. The experimental apparatus has been described in detail recently.[37] The cations were produced in a Smalley-type laser vaporization supersonic cluster source.[39] The 1064 nm fundamental of a Nd:YAG laser (Continuum, Minilite II, 10 Hz repetition rate and 6 ns pulse width) was used to vaporize a rotating iron metal target. The laser beam with 5–8 mJ per pulse is focused by a lens with a focal length of 300 mm. The iron carbonyl complexes were produced from the laser vaporization process in expansions of helium gas seeded with 4–6% CO using a pulsed valve (General Valve, Series 9) at 4–6 MPa backing pressure. After free expansion, the cations were skimmed and analyzed using a Wiley–McLaren time-of-flight mass spectrometer. The clusters of interest were each mass selected and decelerated into the extraction region of a second collinear time-of-flight mass spectrometer, where they were dissociated by a tunable IR laser. The fragment and parent cations were reaccelerated and mass analyzed by the second time-of-flight mass spectrometer.

The infrared source used in this study is generated by an KTP/KTA/AgGaSe2 optical parametric oscillator/amplifier system (OPO/OPA, Laser Vision) pumped by a Continuum Powerlite 8000 Nd:YAG laser, which is tunable from 900 to 5000 cm^{-1}, producing about 1–2 mJ per pulse near 2100 cm^{-1}. The infrared laser is loosely focused by a CaF_2 lens. The wavenumber of the OPO laser is calibrated using CO absorptions. The IR beam path is purged with nitrogen to minimize absorptions by air. Fragment ions and undissociated parent ions are detected by a dual micro-channel plate detector. The ion signal is amplified, collected on a gated integrator, and averaged with a LabView based program. The photodissociation spectrum is obtained by monitoring the yield of the fragment ion of interest as a function of the dissociation IR laser wavelength and normalizing to parent ion signal. Typical spectra were recorded by scanning the dissociation laser in steps of 2 cm^{-1} and averaging over 250 laser shots at each wavelength.

First principle density functional theory (DFT) calculations were performed to determine the molecular structures and to support the assignment of vibrational frequencies of the observed iron carbonyl cations. Geometry optimization and harmonic vibrational frequency analysis were performed with the hybrid B3LYP method in combination with the 6-31+G(d) basis set.[40,41] The B3LYP functional is the most popular density functional method and can provide reliable predictions on the structures and vibrational frequencies of transition metal-containing compounds.[42] Previous studies have shown that B3LYP can give good energetic and vibrational results for iron carbonyls.[18,19,33] The stability of the wavefunctions was checked by the "stable" technique as implemented in the Gaussian 09 program to ensure that the wavefunctions have no internal instability.[43,44] The spin contamination of the DFT wavefunction is not severe. For example, the $<S^2>$ of the wavefunctions of the lowest-energy structures of $Fe(CO)_6^+$, $Fe_2(CO)_7^+$, $Fe_2(CO)_8^+$, $Fe_2(CO)_9^+$, and $Fe_3(CO)_{12}^+$ are 0.76, 3.80, 3.82, 0.78, and 3.82, while the corresponding ideal values are 0.75, 3.75, 3.75, 0.75, and 3.75, respectively. It is well known that spin contamination has much smaller influence on the results of DFT calculations than those of the HF wavefunction based methods. For each structure both doublet and quartet spin states were considered. Spin states higher than quartet are expected to have higher energies. The ground state of the bare Fe^+ cation has a sextet ground state with $3d^54s^2$ electronic configuration. The iron carbonyl cations prefer low spin ground electronic states to favour the metal–CO bonding. The neutral $Fe(CO)_5$, $Fe_2(CO)_9$ and $Fe_3(CO)_{12}$ molecules all are closed-shell species. The integral grid used for all the DFT calculations is a pruned (99 590) grid (the "ultrafine" grid as defined by Gaussian 09). All calculations were performed with the Gaussian 09 suite of quantum chemical software packages.[44]

Theoretical predicted IR spectra were obtained by applying Lorentzian functions with the theoretical harmonic vibrational frequencies scaled by a factor of 0.9662 and a 10 cm^{-1} full width at half-maximum (fwhm). The scaling factor of 0.9662 was determined to give vibrational frequencies closest to the experimental vibrational frequencies of the neutral $Fe(CO)_5$ and $Fe_2(CO)_9$ molecules.[45,46]

Results and discussion

A mass spectrum of iron carbonyl cluster cations produced by a laser vaporization supersonic cluster source with relatively higher CO backing pressure in the *m/z* range of 0–600 is shown in Fig. 1. The mass spectrum is dominated by the signals of saturated cationic iron cluster carbonyls corresponding to the species $Fe(CO)_5^+$, $Fe_2(CO)_9^+$ and $Fe_3(CO)_{12}^+$. The $Fe(CO)_6^+$ and $Fe_2(CO)_8^+$ cations also exhibit quite high abundance. For each species, the isotopic splitting of iron can clearly be resolved with their relative intensities matching the natural abundance isotopic distributions. The carbonyl cluster cations of interest are each mass-selected and subjected to infrared photodissociation. When

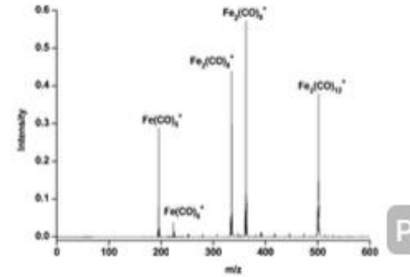

Fig. 1 Mass spectrum of the iron carbonyl cluster cations produced by pulsed laser vaporization of an iron metal target in an expansion of helium seeded by carbon monoxide.

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the frequency of the IR laser irradiation is in resonance with
CO stretching vibration of the cluster cations, photofragmentio
of the cations takes place. The photofragmentation mass spectr
are shown in Fig. 2.

$Fe(CO)_5^+$

The $Fe(CO)_5^+$ cation dissociates *via* loss of one CO ligand onl
under focused IR laser irradiation with very low efficiency. Th
parent ions can be depleted by about 10% at the laser puls
energy of about 1.5 mJ per pulse. The fifth CO binding energy o
$Fe(CO)_5^+$ was determined experimentally to be 26.8 ± 0.9 kca
mol^{-1},[34] significantly higher than the energy of IR photons in th
CO stretching region. The dissociation detected is due to th
multiphoton absorption process, which is not expected to be ver
efficient at the laser pulse energies used here. The photodissoci-
ation spectrum of $Fe(CO)_5^+$ is shown in Fig. 3. The spectrum
exhibits a single band centered at 2123 cm^{-1}, which is abou
20 cm^{-1} red-shifted from the free CO stretching (fundamental a
2143 cm^{-1}).[47] Density functional calculations predicted a ^2A
ground state for $Fe(CO)_5^+$ with square pyramidal C_{4v} structure
as is the isoelectronic $Mn(CO)_5$ molecule.[48,49] The axial Fe–
bond is slightly longer than the four equatorial Fe–C bonds. Th
computed spectrum (also shown in Fig. 3) agrees well with th
experiment. The $Fe(CO)_5^+$ cation with C_{4v} symmetry is expecte
to have five CO stretching modes (Table 1). The doubly degen-
erate antisymmetric stretching mode of the equatorial CO unit
and the stretching of the axial CO unit were predicted to hav
appreciable IR intensities. These two modes are calculated t
split by only about 6 cm^{-1}. The band observed in the I
photodissociation spectrum is an unresolved doublet involvin
both modes.

$Fe(CO)_6^+$

The $Fe(CO)_6^+$ cation is observed to dissociate by losing one C
ligand very efficiently even when using an unfocused laser beam
indicating that the dissociation proceeds *via* a single photo

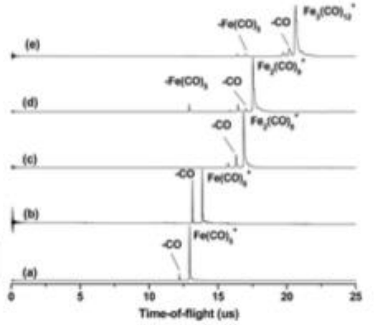
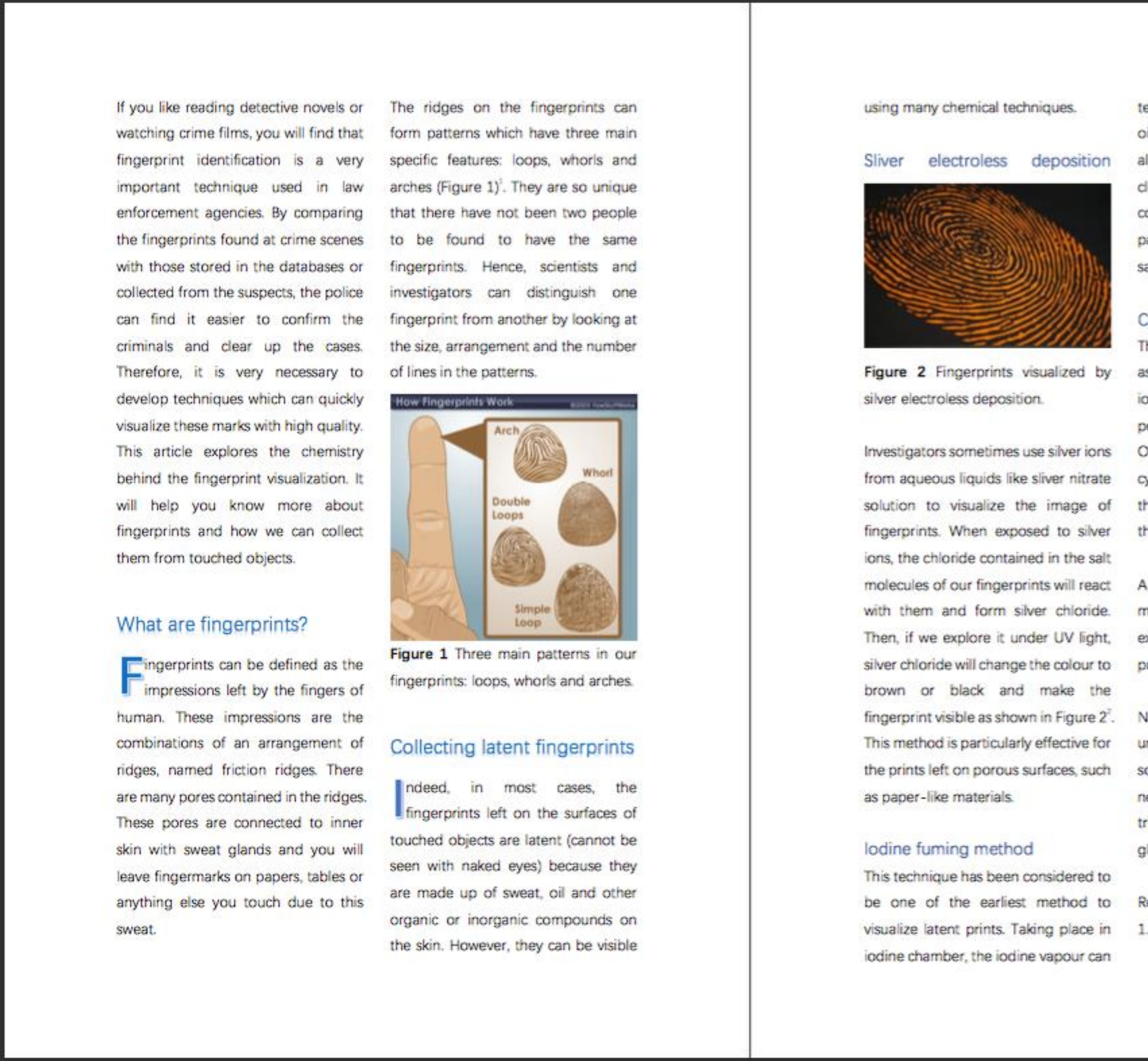


Fig. 2 The photofragmentation mass spectra of the $Fe_n(CO)_m^+$ cluste
cations.

The chemistry of
Fingerprinting techniques



If you like reading detective novels or watching crime films, you will find that fingerprint identification is a very important technique used in law enforcement agencies. By comparing the fingerprints found at crime scenes with those stored in the databases or collected from the suspects, the police can find it easier to confirm the criminals and clear up the cases. Therefore, it is very necessary to develop techniques which can quickly visualize these marks with high quality. This article explores the chemistry behind the fingerprint visualization. It will help you know more about fingerprints and how we can collect them from touched objects.

What are fingerprints?

Fingerprints can be defined as the impressions left by the fingers of human. These impressions are the combinations of an arrangement of ridges, named friction ridges. There are many pores contained in the ridges. These pores are connected to inner skin with sweat glands and you will leave fingermarks on papers, tables or anything else you touch due to this sweat.

The ridges on the fingerprints can form patterns which have three main specific features: loops, whorls and arches (Figure 1)[1]. They are so unique that there have not been two people to be found to have the same fingerprints. Hence, scientists and investigators can distinguish one fingerprint from another by looking at the size, arrangement and the number of lines in the patterns.

Figure 1 Three main patterns in our fingerprints: loops, whorls and arches.

Collecting latent fingerprints

Indeed, in most cases, the fingerprints left on the surfaces of touched objects are latent (cannot be seen with naked eyes) because they are made up of sweat, oil and other organic or inorganic compounds on the skin. However, they can be visible using many chemical techniques.

Sliver electroless deposition

Figure 2 Fingerprints visualized by silver electroless deposition.

Investigators sometimes use silver ions from aqueous liquids like sliver nitrate solution to visualize the image of fingerprints. When exposed to silver ions, the chloride contained in the salt molecules of our fingerprints will react with them and form silver chloride. Then, if we explore it under UV light, silver chloride will change the colour to brown or black and make the fingerprint visible as shown in Figure 2[2]. This method is particularly effective for the prints left on porous surfaces, such as paper-like materials.

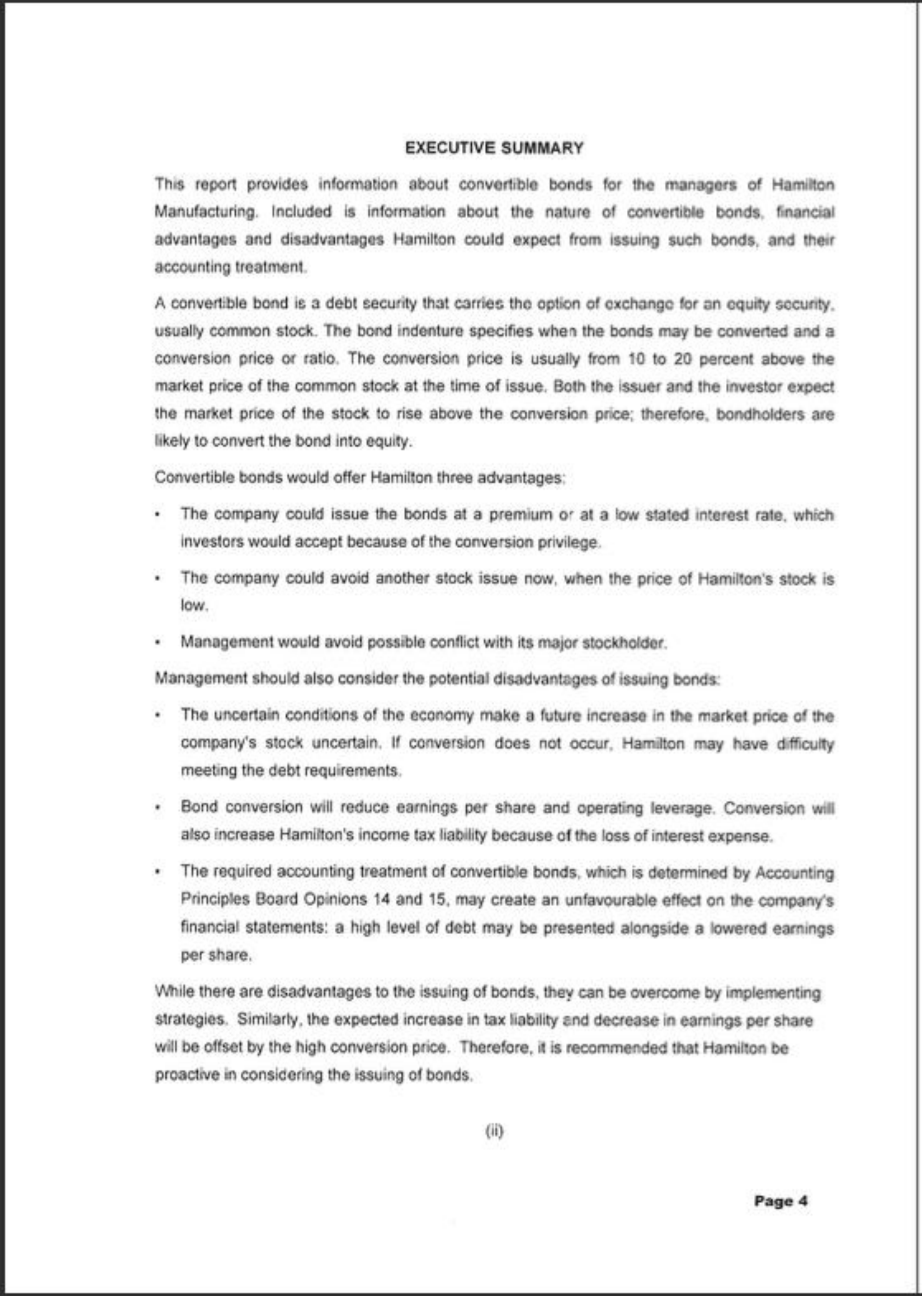
Iodine fuming method

This technique has been considered to be one of the earliest method to visualize latent prints. Taking place in iodine chamber, the iodine vapour can

You and your group work for a UK supermarket chain. Below is an extract from an email you receive from your boss.

> We've been receiving complaints recently relating to the safety and quality of the following products:
>
> - Fresh salmon fillets
> - Frozen minced beef
> - Hot cross buns
> - Tinned tomatoes
> - Mature cheddar cheese
>
> Could you write a report on the food safety and quality issues involved when producing one of these products?
>
> Please address the following questions:
>
> - What are the most significant food safety and quality issues from farm to fork?
> - How can they be mitigated?
> - What improvements could we make to our supply chain, production methods or food labelling?
>
> The company directors will use this report to make improvements to the safety and quality of our products.

Write your **report** in a format and style appropriate to the situation.



EXECUTIVE SUMMARY

This report provides information about convertible bonds for the managers of Hamilton Manufacturing. Included is information about the nature of convertible bonds, financial advantages and disadvantages Hamilton could expect from issuing such bonds, and their accounting treatment.

A convertible bond is a debt security that carries the option of exchange for an equity security, usually common stock. The bond indenture specifies when the bonds may be converted and a conversion price or ratio. The conversion price is usually from 10 to 20 percent above the market price of the common stock at the time of issue. Both the issuer and the investor expect the market price of the stock to rise above the conversion price; therefore, bondholders are likely to convert the bond into equity.

Convertible bonds would offer Hamilton three advantages:

- The company could issue the bonds at a premium or at a low stated interest rate, which investors would accept because of the conversion privilege.
- The company could avoid another stock issue now, when the price of Hamilton's stock is low.
- Management would avoid possible conflict with its major stockholder.

Management should also consider the potential disadvantages of issuing bonds:

- The uncertain conditions of the economy make a future increase in the market price of the company's stock uncertain. If conversion does not occur, Hamilton may have difficulty meeting the debt requirements.
- Bond conversion will reduce earnings per share and operating leverage. Conversion will also increase Hamilton's income tax liability because of the loss of interest expense.
- The required accounting treatment of convertible bonds, which is determined by Accounting Principles Board Opinions 14 and 15, may create an unfavourable effect on the company's financial statements: a high level of debt may be presented alongside a lowered earnings per share.

While there are disadvantages to the issuing of bonds, they can be overcome by implementing strategies. Similarly, the expected increase in tax liability and decrease in earnings per share will be offset by the high conversion price. Therefore, it is recommended that Hamilton be proactive in considering the issuing of bonds.

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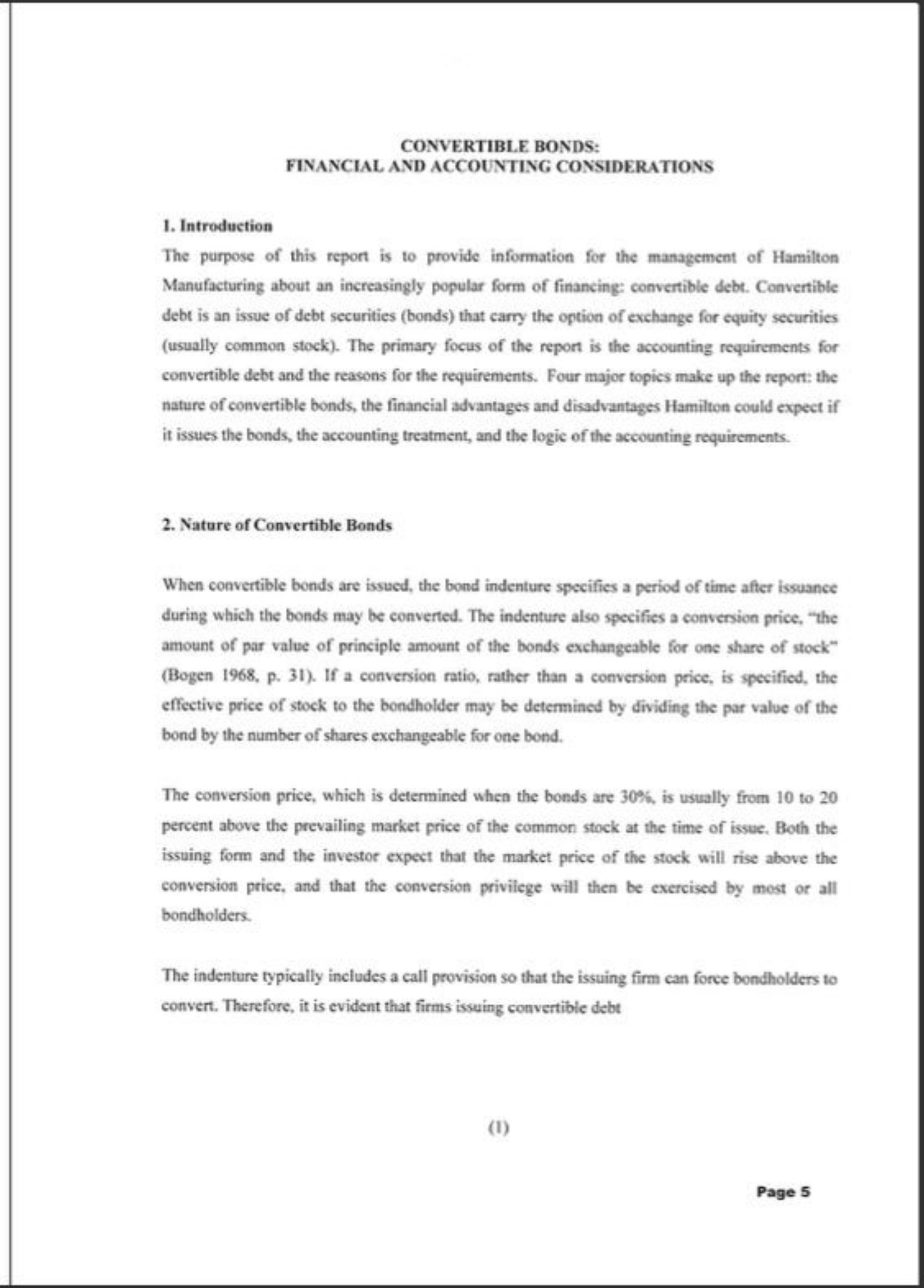

CONVERTIBLE BONDS:
FINANCIAL AND ACCOUNTING CONSIDERATIONS

1. Introduction

The purpose of this report is to provide information for the management of Hamilton Manufacturing about an increasingly popular form of financing: convertible debt. Convertible debt is an issue of debt securities (bonds) that carry the option of exchange for equity securities (usually common stock). The primary focus of the report is the accounting requirements for convertible debt and the reasons for the requirements. Four major topics make up the report: the nature of convertible bonds, the financial advantages and disadvantages Hamilton could expect if it issues the bonds, the accounting treatment, and the logic of the accounting requirements.

2. Nature of Convertible Bonds

When convertible bonds are issued, the bond indenture specifies a period of time after issuance during which the bonds may be converted. The indenture also specifies a conversion price, "the amount of par value of principle amount of the bonds exchangeable for one share of stock" (Bogen 1968, p. 31). If a conversion ratio, rather than a conversion price, is specified, the effective price of stock to the bondholder may be determined by dividing the par value of the bond by the number of shares exchangeable for one bond.

The conversion price, which is determined when the bonds are 30%, is usually from 10 to 20 percent above the prevailing market price of the common stock at the time of issue. Both the issuing form and the investor expect that the market price of the stock will rise above the conversion price, and that the conversion privilege will then be exercised by most or all bondholders.

The indenture typically includes a call provision so that the issuing firm can force bondholders to convert. Therefore, it is evident that firms issuing convertible debt

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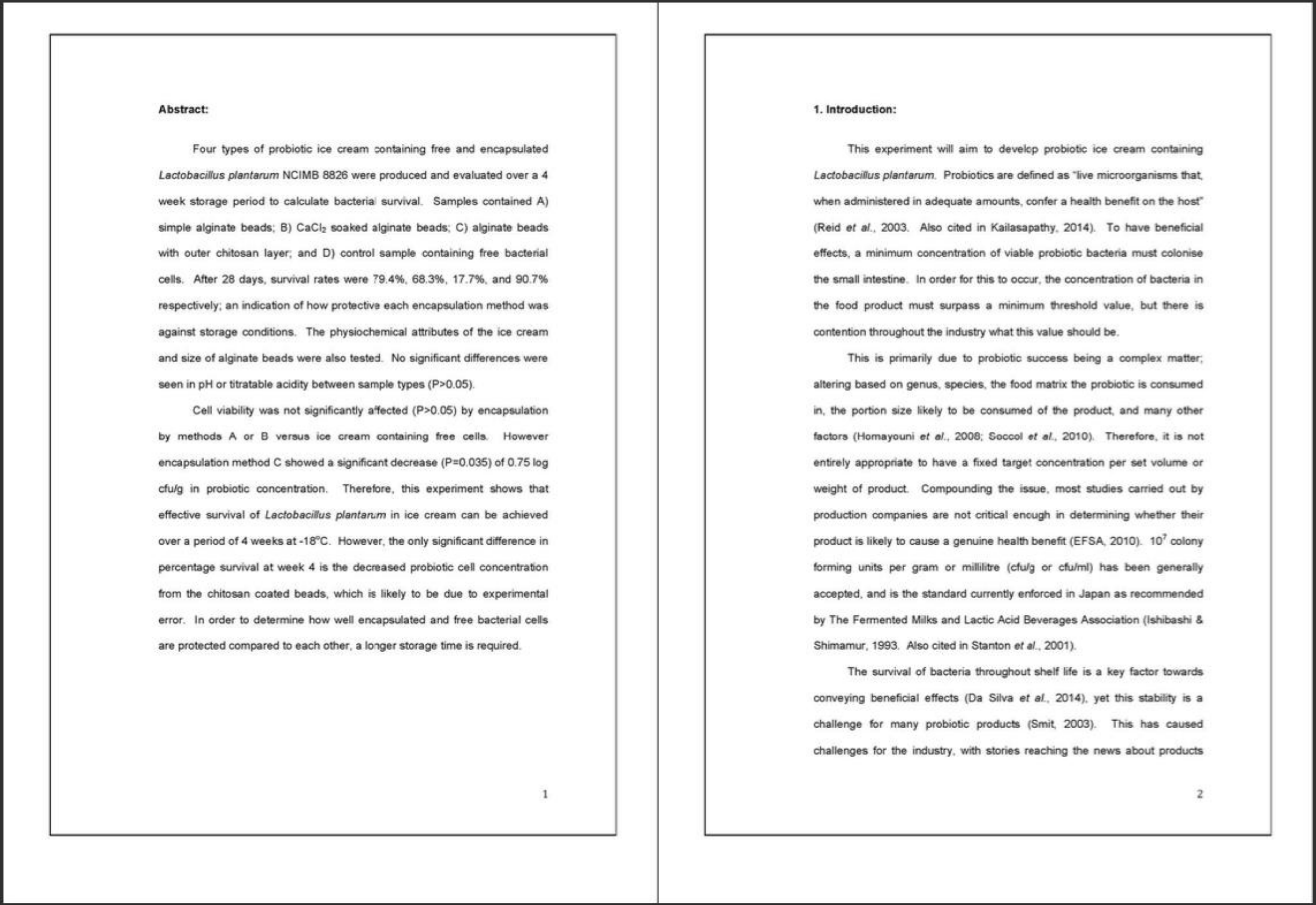


Abstract:

Four types of probiotic ice cream containing free and encapsulated *Lactobacillus plantarum* NCIMB 8826 were produced and evaluated over a 4 week storage period to calculate bacterial survival. Samples contained A) simple alginate beads; B) $CaCl_2$ soaked alginate beads; C) alginate beads with outer chitosan layer; and D) control sample containing free bacterial cells. After 28 days, survival rates were 79.4%, 68.3%, 17.7%, and 90.7% respectively; an indication of how protective each encapsulation method was against storage conditions. The physiochemical attributes of the ice cream and size of alginate beads were also tested. No significant differences were seen in pH or titratable acidity between sample types ($P>0.05$).

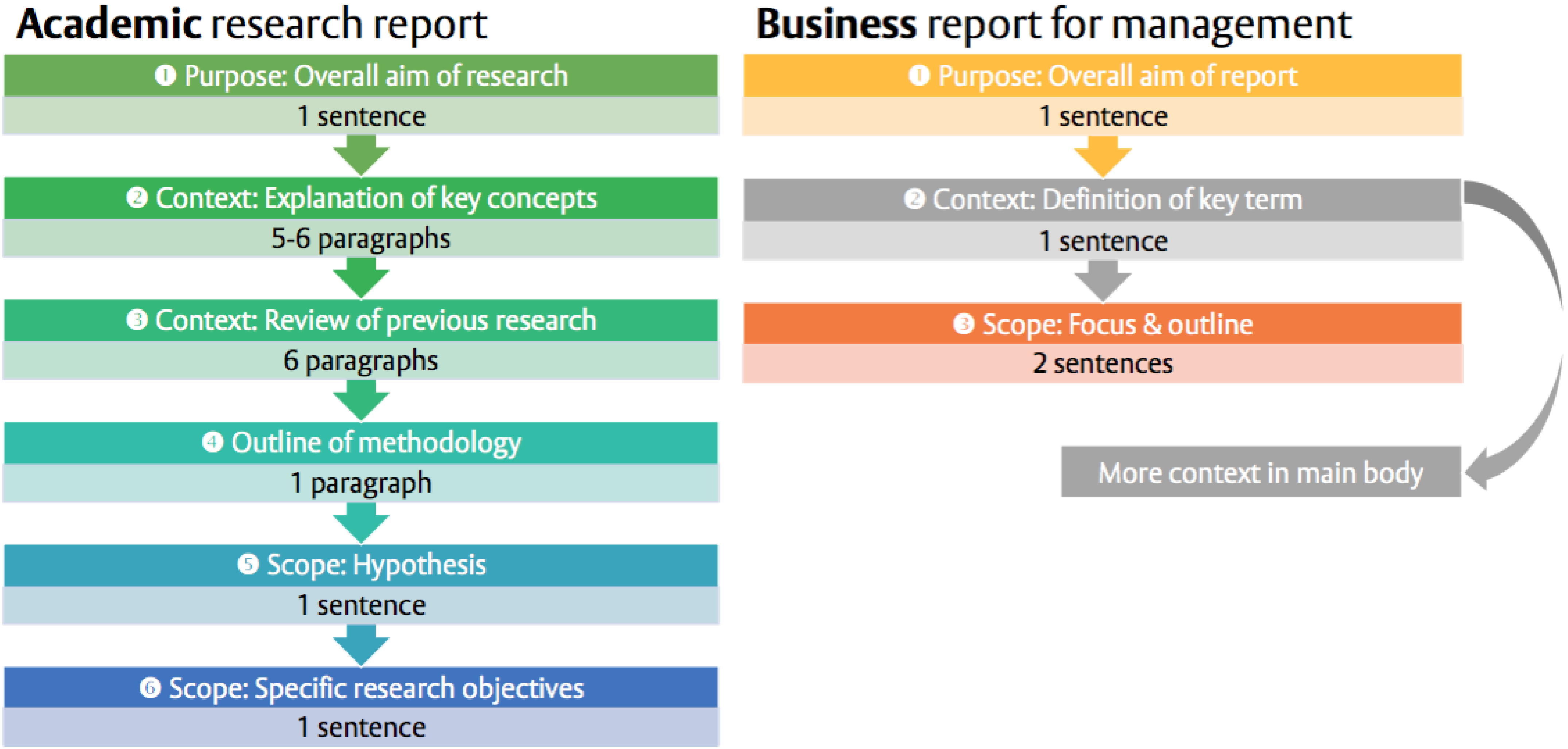
Cell viability was not significantly affected ($P>0.05$) by encapsulation by methods A or B versus ice cream containing free cells. However encapsulation method C showed a significant decrease ($P=0.035$) of 0.75 log cfu/g in probiotic concentration. Therefore, this experiment shows that effective survival of *Lactobacillus plantarum* in ice cream can be achieved over a period of 4 weeks at -18°C. However, the only significant difference in percentage survival at week 4 is the decreased probiotic cell concentration from the chitosan coated beads, which is likely to be due to experimental error. In order to determine how well encapsulated and free bacterial cells are protected compared to each other, a longer storage time is required.

1. Introduction:

This experiment will aim to develop probiotic ice cream containing *Lactobacillus plantarum*. Probiotics are defined as "live microorganisms that, when administered in adequate amounts, confer a health benefit on the host" (Reid *et al.*, 2003. Also cited in Kailasapathy, 2014). To have beneficial effects, a minimum concentration of viable probiotic bacteria must colonise the small intestine. In order for this to occur, the concentration of bacteria in the food product must surpass a minimum threshold value, but there is contention throughout the industry what this value should be.

This is primarily due to probiotic success being a complex matter; altering based on genus, species, the food matrix the probiotic is consumed in, the portion size likely to be consumed of the product, and many other factors (Homayouni *et al.*, 2008; Soccol *et al.*, 2010). Therefore, it is not entirely appropriate to have a fixed target concentration per set volume or weight of product. Compounding the issue, most studies carried out by production companies are not critical enough in determining whether their product is likely to cause a genuine health benefit (EFSA, 2010). 10^7 colony forming units per gram or millilitre (cfu/g or cfu/ml) has been generally accepted, and is the standard currently enforced in Japan as recommended by The Fermented Milks and Lactic Acid Beverages Association (Ishibashi & Shimamur, 1993. Also cited in Stanton *et al.*, 2001).

The survival of bacteria throughout shelf life is a key factor towards conveying beneficial effects (Da Silva *et al.*, 2014), yet this stability is a challenge for many probiotic products (Smit, 2003). This has caused challenges for the industry, with stories reaching the news about products



Academic research report

❶ Purpose: Overall aim of research
1 sentence

❷ Context: Explanation of key concepts
5-6 paragraphs

❸ Context: Review of previous research
6 paragraphs

❹ Outline of methodology
1 paragraph

❺ Scope: Hypothesis
1 sentence

❻ Scope: Specific research objectives
1 sentence

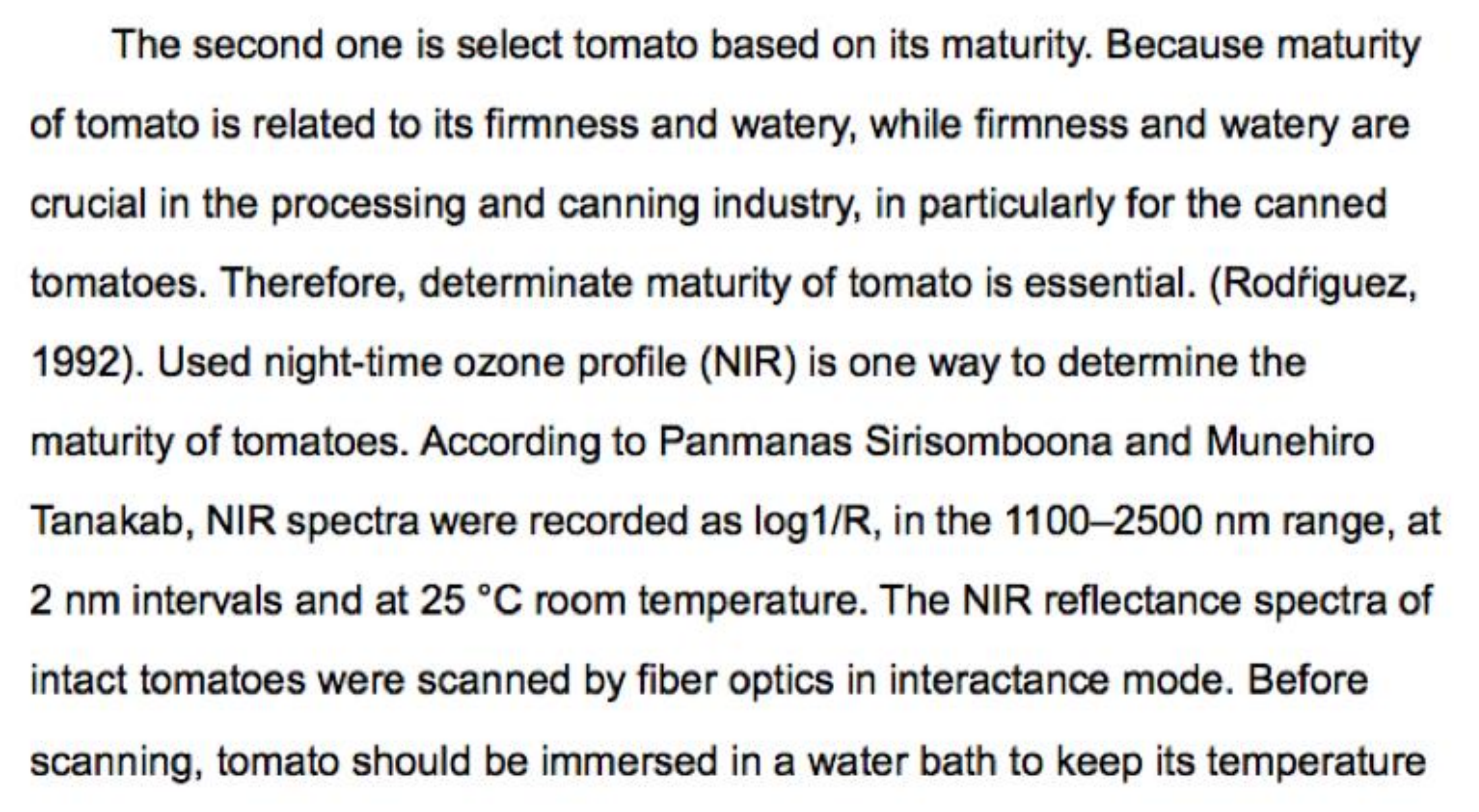
Business report for management

❶ Purpose: Overall aim of report
1 sentence

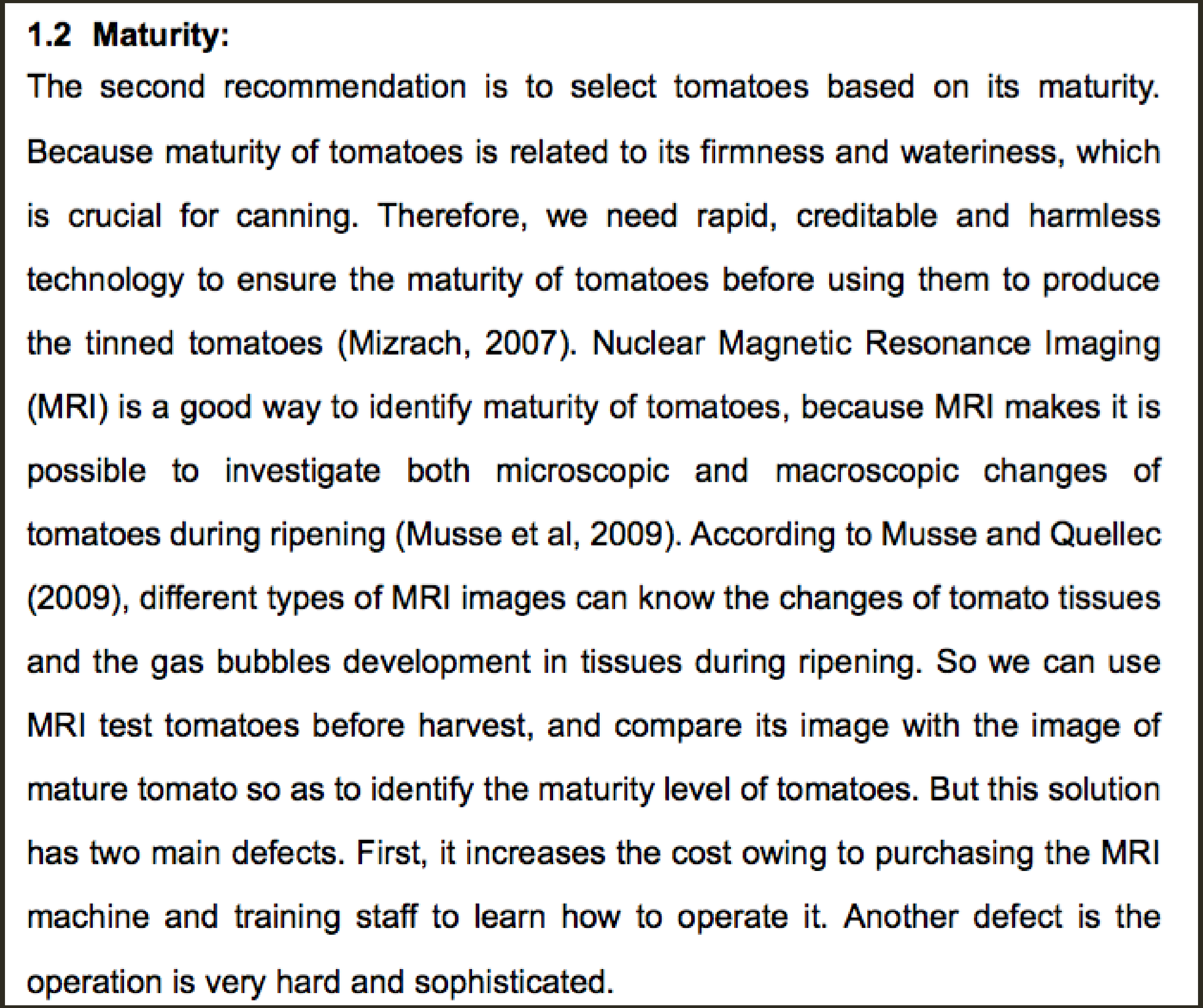
❷ Context: Definition of key term
1 sentence

❸ Scope: Focus & outline
2 sentences

More context in main body



The second one is select tomato based on its maturity. Because maturity of tomato is related to its firmness and watery, while firmness and watery are crucial in the processing and canning industry, in particularly for the canned tomatoes. Therefore, determinate maturity of tomato is essential. (Rodŕiguez, 1992). Used night-time ozone profile (NIR) is one way to determine the maturity of tomatoes. According to Panmanas Sirisomboona and Munehiro Tanakab, NIR spectra were recorded as log1/R, in the 1100–2500 nm range, at 2 nm intervals and at 25 °C room temperature. The NIR reflectance spectra of intact tomatoes were scanned by fiber optics in interactance mode. Before scanning, tomato should be immersed in a water bath to keep its temperature



1.2 Maturity:

The second recommendation is to select tomatoes based on its maturity. Because maturity of tomatoes is related to its firmness and wateriness, which is crucial for canning. Therefore, we need rapid, creditable and harmless technology to ensure the maturity of tomatoes before using them to produce the tinned tomatoes (Mizrach, 2007). Nuclear Magnetic Resonance Imaging (MRI) is a good way to identify maturity of tomatoes, because MRI makes it is possible to investigate both microscopic and macroscopic changes of tomatoes during ripening (Musse et al, 2009). According to Musse and Quellec (2009), different types of MRI images can know the changes of tomato tissues and the gas bubbles development in tissues during ripening. So we can use MRI test tomatoes before harvest, and compare its image with the image of mature tomato so as to identify the maturity level of tomatoes. But this solution has two main defects. First, it increases the cost owing to purchasing the MRI machine and training staff to learn how to operate it. Another defect is the operation is very hard and sophisticated.

BENEFITS & DRAWBACKS

Benefits

Facilitates writing in own words

- deconstructing technical writing
- clear communication of scientific ideas

Enables English teachers to mark with confidence

Prepares students for workplace

- developing graduate attributes

Drawbacks

Students do not write in academic scientific prose

- constructing technical writing

Students not prepared for academic scientific writing

GRADUATE ATTRIBUTES

”The curriculum [at the University of Reading] seeks to engender the following attributes …

[the] ability to communicate effectively …

for a variety of purposes and audiences, and

through a range of appropriate media

(University of Reading, 2016, p. 2)

GENRE AS A PEDAGOGICAL RESOURCE

Writing in different genres for non-expert audiences can

“enable students to develop

not only a meaningful genre awareness

but also a deeper understanding of their disciplinary knowledge”

(English, 2015)

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