جامعة الملك سعود
King Saud University

أسس كتابة البحث العلمي

عناصر العرض

- ما هو البحث العلمي
- المستويات الأساسية للبحوث
- خطوات كتابة البحث العلمي
- أجزاء البحث الرئيسية

ما هو البحث العلمي؟

البحث العلمي هو جهد دراسي منهجي يهدف الى حل مشكلة معينة في تخصص ما، بحيث يقدم مساهمة حقيقية لهذا التخصص.

المستويات الأساسية للبحوث

1) المقالة

هي بحث قصير يقوم به الطالب خلال مرحلة البكالوريوس، بناء على طلب أساتذته.

- تهدف إلى تدريب الطالب على
  - تنظيم أفكاره وعرضها بصورة سليمة
  - استخدام المكتبة ومصادرها
  - الأمانة وتحمل المسؤولية في نقل المعلومات.
- قد لا يتعدى حجم البحث عشر صفحات.

المستويات الأساسية للبحوث

2) مشروع البحث

أحد متطلبات التخرج بدرجة البكالوريوس، وهو من البحوث القصيرة، إلا أن أكثر تعمقا من المقالة.

- الغرض منه هوتدريب الطالب على
  - اختيار موضوع البحث.
  - تحديد الإشكالية التي سيتعامل معها، ووضع الاقتراحات اللازمة لها.
  - اختيار الأدوات المناسبة للبحث.
  - طرق منهجية البحث العلمى الترتيب والتفكير المنطقي السليم.
- ليس المقصود منه التوصل إلى ابتكارات جديدة أو إضافات مستحدثة.

المستويات الأساسية للبحوث

3) الرسالة Thesis

بحث يرقى في مفهومه عن المقالة أو مشروع البحث، ويعتبر أحد المتممات لنيل درجة علمية عالية. عادة ما تكون درجة الماجستير.

- الهدف الأول منها هو أن يحصل الطالب على تجارب في البحث تحت إشراف أحد الأساتذة ليمكنه ذلك من التحضير للدكتوراه.
- تتصف الرسالة بأنها
  - بحث مبتكر أصيل في موضوع من الموضوعات.
  - تعالج مشكلة يختارها الباحث ويحددها، ويضع افتراضاتها، ويسعى إلى التوصل إلى نتائج جديدة لم تعرف من قبل.
- الرسالة تحتاج إلى مدة زمنية طويلة نسبيا، قد تكون عاما أو أكثر.

المستويات الأساسية للبحوث

4) الأطروحة Dissertation

بحث علمي أعلى درجة من الرسالة، وهي للحصول على درجة الدكتوراه.

- يقوم الباحث باختيار موضوعه، وتحديد اشكاليته، ووضع فرضياته، وتحديد أدواته واختيار مناهجه.
- وذلك من أجل إضافة لبنة جديدة لبنيان العلم والمعرفة.
- تختلف أطروحة الدكتوراه عن الماجستير في أن الجديد الذي تضيفه للمعرفة والعلم يجب أن يكون أوضح وأقوى، وأعمق وأدق، وأن تكون على مستوى أعلى.
- قد يمتد الزمن بالباحث لأكثر من سنة أو سنتين . ربما عدة أعوام.

المستويات الأساسية للبحوث

1) بحوث قصيرة على مستوى الدراسة الجامعية الأولى (البكالوريوس)

2) بحوث متقدمة على مستوى رسالة الماجستير
(Master Thesis)

3) بحوث متقدمة على مستوى رسالة الدكتوراة
(Doctoral Dissertation)

نشر علمي في صورة

- بحث أصيل Original paper
- براءة إختراع Patent
- مقال إستعراضي Review article

خطوات كتابة البحث العلمي

1) اختيار موضوع البحث
2) مراجعة الادبيات
3) تحديد الموضوع بشكله النهائي
4) تدوين مصادر المعلومات الأساسية
5) تجميع وتنظيم الأفكار

خطوات كتابة البحث العلمي

1) اختيار موضوع البحث

- يكون الباحث حرا في اختيار أي موضوع للاجابة عن مجموعة من الأسئلة.
- أغلبية البحوث إنما تخطئ الطريق من نقطة الانطلاق بسبب
  - لكون الأسئلة المطروحة تكون إما بسيطة جدا أو فضفاضة جدا.
  - لكون مجال البحث المختار يكون إما محدد بشكل رديء.
- ولذلك يجب على الباحث أن يفكر ملياً في اختيار العناصر التي تعتبر مبادئ أساسية للبحث وهي:
  - موضوع البحث
  - الإطار المرجعي (أو النظري) للبحث
  - منهج البحث
  - صياغة الإشكالية.

خطوات كتابة البحث العلمي

2) مراجعة الادبيات

هنا تعني مراجعة النظريات والدراسات السابقة ذات الصلة بالموضوع الذي وقع عليه الاختيار والذي يصبح موقع اهتمامنا وانشغالنا.

وهي من اهم خطوات البحث العلمي حيث من خلالها نقدم تبرير بحثنا أي ما هو الجديد الذي سنقدمه او نضيفه على المعرفة وتحدي الاطار المرجعي او النظري الذي سيعتمد، بالاضافة الى التحديد الدقيق لاشكالية البحث .

3) تحديد الموضوع بشكله النهائي

صياغة المشكلة في عبارات واضحه مفهومة ومحددة تعبر عن المضمون.

خطوات كتابة البحث العلمي

4) تدوين مصادر المعلومات الأساسية

تدوين النقاط الهامة سواء كان ذلك (أ) عن طريق ألاقتباس (ب) أو تلخيص الأفكار مع ذكر المصدر باستمرار

5) تجميع وتنظيم الأفكار

بعد تجميع ما يكفي من المعلومات حول موضوع البحث. بعد ذلك يصبح الباحث ملماً نوعاً ما بنواحي موضوعه وبناءً عليه يضع خطة أو هيكلاً عاماً مؤقتاً لبحثه، يراعي فيه الترتيب المنطقي المتسلسل والترابط بين أجزائه ويختار له عنواناً مختصراً واضحاً، على أن تكون هذه الخطة خاضعة للتعديل من حذف وإضافة فيما بعد . ثم يبدأ بكتابة البحث.

أجزاء البحث الرئيسة

Origins of Scientific Writing

Question from

○ ***What*** ***was the problem?***	***Answer*** ***= Introduction***
○ ***How*** ***was the problem studied?***	***Answer*** ***= Methods***
○ ***What*** ***are the results?***	***Answer*** ***= Results***
○ ***What*** ***do the findings mean?***	***Answer*** ***= Discussion***

Elements of The Scientific Research Paper

A scientific original article usually consists of the following elements:

- **Title -** descriptive and concise.
- **Abstract –** a short summary of the article.
- **Introduction –** background information, aim and problem statements.
- **Methodology –** so that the reader can follow and repeat the research process.
- **Result -** presentation of the research results.
- **Discussion –** interpretation and evaluation of the results.
- **Conclusions** and relation to previous research.
- **References -** all documents that the author has referred to must be listed.

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Taylor & Francis

Microwave Synthesis of Copolymers Based on Itaconic Acid Moiety and Their Utility for Scavenging of Copper (II) and Lead (II)

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We report here the preparation of the two copolymers, itaconic a
ration using microwave irradiation in the presence of azobisisobu
prepared copolymers were characterized by different techniques;
stability property of the prepared copolymers correlated with th
increased, the crystallinity of the copolymer decreases. The itacon
in alkaline media for Cu (II) and Pb (II). The chelation behavior
thermogravimetric analysis (TGA), and differential scanning calo

Keywords: Microwave synthesis, itaconic acid, copolymerization,

1 Introduction

The microwave technique is safe, fast and gives high yield of the products with high purity in an optimum time, comparing to the conventional method. Recently, there has been growing interest in applying microwave irradiation to synthetic organic chemistry, (1–8) sample preparation for analysis, (9) extraction of natural products from plants, (10) waste treatment, (11) and polymer synthesis (12–15).

The design of suitable polymeric materials is an increasingly important research area due to demands for

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Color versions of one or more figures in this article can be found online at www.tandfonline.com/lmsa.

Table 1. Yield (%) of MMA/IA and AA/IA copolymers using microwave irradiation

Method	Copolymer code	MMA/IA Ratio	MMA (mmol)	IAA (mmol)	Yield (%)
Conventional	PMIAA 5	10:4	20		
Microwave	PMIAA 10	10:1	100		
	PMIAA 11	10:2	100		
	PMIAA 12	10:4	50		
Method	Copolymer code	AA/IA Ratio	AA (mmol)		
Microwave	PAIAA 13	10:1	100		
	PAIAA 14	10:2	100		
	PAIAA 15	10:4	100		

an ecofriendly method for preparation of the desired copolymers. The work also describes the ability of the two copolymers for scavenging of heavy metal such as Cu (II) and Pb (II).

2 Experimental

2.1 Materials

Itaconic acid (IAA), acrylamide (AA) and methyl methacrylate (MMA) were supplied from Sigma-Aldrich. *N,N'*-Azobisisobutyronitrile (AIBN) was supplied from Hanover and was re-crystallized from absolute ethanol before use. Lead (II) nitrate and copper (II) sulfate were supplied from Fluka. All solvents were dried before use.

2.2 Measurements

The microwave irradiation employing a multimode reactor (Synthos 3000, Anton Paar GmbH, and 1400 W maximum magnetron) was used to prepare the copolymers. Fourier transform infrared spectroscopy (FT-IR) spectra were recorded on a Nicolet 560 Magna Spectrometer. Thermal properties of the copolymers and their complexes were examined using thermogravimetric analysis (TGA) under nitrogen, in the temperature range 30–800°C with a heating rate of 10°C/min, and differential scanning calorimetry (DSC) which was carried out using TA-Q500 in which Specimens of (5–10 mg) were encapsulated in aluminium pans and were heated or cooled between −25°C and 400°C under dry nitrogen atmosphere with heating rate of 10°C /min. Elemental microanalysis tests were performed on (Perkin-Elmer, 2400 series), the sample was burned in an excess of oxygen, and various traps collect the combustion products-carbon dioxide, water, and nitric oxide. The masses of these combustion products have been used to calculate the composition of the sample. The measurements of lead (Pb) and Copper (Cu) were performed using Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES), (ICAP 6000 SERIES). All the samples were performed in triplicate and the results reported

cooling was accomplished by a fan (5 min). The final product poly(methyl methacrylate-*co*-itaconic acid) -PMIAA or poly(acrylamide-co-itaconic acid)–PAIAA was washed with diethyl ether, and then dried in oven under vacuum at 40°C for 24 h.

2.5 Copolymers Complexes of Cu^{2+} and Pb^{2+}

For all preparations, doubly distilled water was employed as a solvent. All used reagents were of analytical grade and were employed without further purification. Copper (II) sulphate and Pb (II) nitrate (1 mmol) were dissolved in 20 mL of water and then the prepared solutions were slowly added to 25 cm^3 of an aqueous solution with 2 mmol of each itaconic acid copolymers with stirring. The pH of each solution was adjusted to 6–8 by addition of ammonium hydroxide. The resulting solutions were heated at 70°C and left to evaporate slowly at room temperature overnight. The obtained precipitate were filtered off, washed with hot water and was dried in oven under vacuum at 70°C.

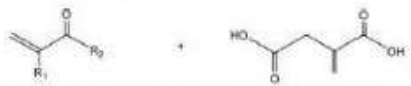
3 Results and Discussion

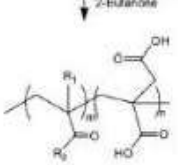
3.1 Synthesis of Copolymers

The two copolymers itaconic acid-methyl methacrylate and itaconic acid-acrylamide (PMIAA and PAIAA) with different ratios were prepared using a multimode reactor (Synthos 3000, Anton Paar GmbH, 1400 W maximum magnetron), in the presence of AIBN for 5 min at 140°C and 400W. For comparison study, the copolymer PMIAA 3 (10:4 MMA:IAA) was prepared by conventional method using 2-butanone as a solvent and AIBN as initiator at 60°C, under nitrogen atmosphere for 24 h (Table 1 and Sch. 1). The prepared copolymers were characterized using FT-IR spectrum, TGA, DSC, and micronalysis.

3.2 Fourier Transform Infrared Spectroscopy (FT

The FT-IR of the poly(methyl methacrylate-*co*-itaconic acid)–PMIAA, showed the characteristic peaks of the acid group and the ester at 3700–2500 cm^{-1} for the carboxylic hydroxyl group (OH), at 1630 cm^{-1} the carboxyl carbonyl group (C=O), and at 1690 cm^{-1} the carbonyl ester (C=O) of methyl methacrylate respectively (Fig. 1a). Also, FT-IR for poly(acrylamide-*co*-itaconic acid)–PAIAA showed similar absorption for the acid group, carboxylic hydroxyl group at 3700–2500 cm^{-1} the carbonyl group (C=O), beside the carbonyl amide (CONH) for the acrylamide moiety at 1640 cm^{-1}, 1349 cm^{-1} for the NH (Fig. 1b). The IR spectra showed that, the intensity of the –OH and –C=O of the acid group was increased as the ratio of IAA increased in the copolymer.





R1 = CH3, R2 = OCH3 Polymethyl methacrylate-co-itaconic acid)–PMIAA
R1 = H, R2 = NH2 Polyacrylamide-co-itaconic acid) -PAIAA

Sch. 1. Copolymerization of itaconic acid with acrylic monomers.

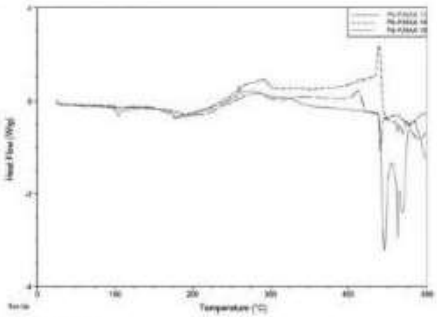


Fig. 18. DSC scan of Pb-PAIAA series.

(DSC). The thermogravimetric thermograms showed a similar data to Pb-PMIAA, were obtained for (Pb-PAIAA 13–14), but not for Pb-PAIAA 15, where the copolymer loaded with lead have only a very sharp endothermic peak at 350°C, which is the same like Cu-PAIAA. Thermograms of DSC are shown in (Fig. 18), which shows similar behavior of the copper containing copolymers series.

4 Conclusions

In conclusion, we have demonstrated that microwave irradiation could be employed efficiently for the synthesis of two types of copolymers contained methyl methacrylate and acrylamide with different ratios of itaconic acid in short time with high yield and purity. The thermal stability property of the prepared copolymer correlated with the changing of the itaconic acid ratio, as the ratio of itaconic acid increased, the crystallinity of the copolymer decreases.

The itaconic acid-based copolymers also showed a good scavenging behavior in alkaline media for Cu (II) and Pb (II). Thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC) showed that the thermal stability of the copolymers increase with increasing the content of Copper metal (Cu^{2+}) or Lead metal (Pb^{2+}).

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King Saud University
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Chemistry Department

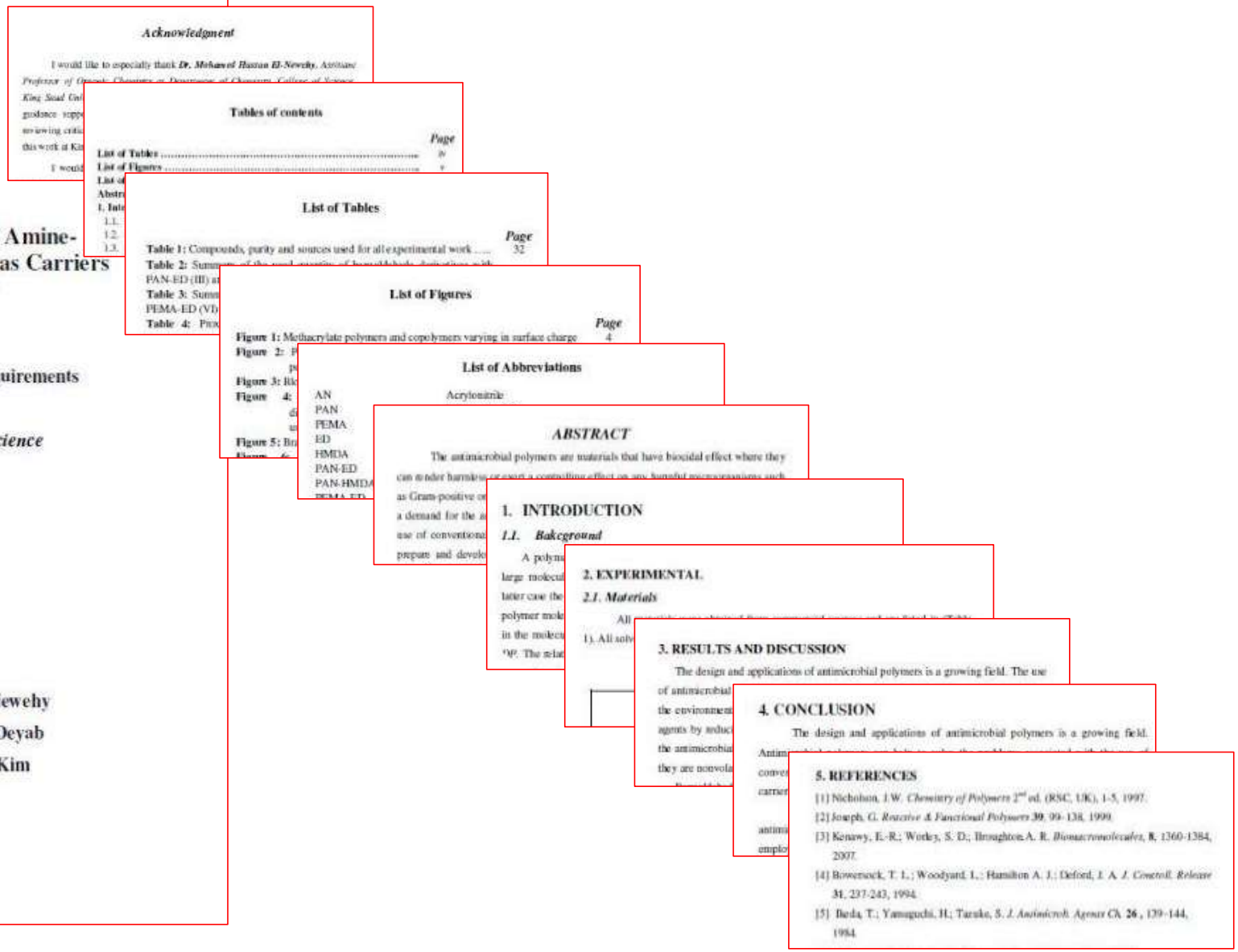
Synthesis and Characterization of Amine-Terminated Polymers and Their Use as Carriers for Antimicrobial Agents

Submitted in Partial Fulfillment of the Requirements
For
Master Degree of Science in Polymer Science
Department of Chemistry
College of Science
King Saud University

By
Abdullah Ali Al-Amri

Supervisor: Dr. Mohamed Hassan El-Newehy
Co-Supervisor: Prof. Dr. Salem S. Al-Deyab
Co-Supervisor: Prof. Dr. Hak Yong Kim

1433(H)-2012(G)



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List of Abbreviations

AN	Acrylonitrile
PAN	
PEMA	
ED	
HMDA	
PAN-ED	
PAN-HMDA	
PEMA-ED	

ABSTRACT

The antimicrobial polymers are materials that have biocidal effect where they can render harmless or exert a controlling effect on any harmful microorganisms such as Gram-positive or... a demand for the ... use of conventiona... prepare and develo...

1. INTRODUCTION

1.1. Bakcground

A polym... large molecul... latter case the... polymer mole... in the molecu... ⁽⁹⁾. The relat...

2. EXPERIMENTAL

2.1. Materials

All ... 1). All solv...

3. RESULTS AND DISCUSSION

The design and applications of antimicrobial polymers is a growing field. The use of antimicrobial... the environment... agents by reduc... the antimicrobia... they are nonvola...

4. CONCLUSION

The design and applications of antimicrobial polymers is a growing field. Antim... conve... carrier... antimi... emplo...

5. REFERENCES

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Title

- **Importance:** read by thousand of people (only few if any will read the full paper).
- The title of your report should be concise and informative.
- Your title should be no longer than 15 words.
  - Not to short: need for specific title (no general).
  - Not to long: not an abstract.
  - No waste words (study on …., observation on …., ect).
  - No abbreviations.
- The title is generally given on a separate page together with your name, course and instructor details.

How to prepare the Abstract?

- The abstract is a brief summary of the whole report (a single paragraph between 100 and 200 words).
- Its function is to preview the contents of your report.

  Goal = Allows the reader to decide to read or not
- Each word and sentence included in your abstract needs to be meaningful.

How to prepare the Abstract?

- **Structure**
  - the aim or objective of the experiment,
  - a short description of the method used,
  - the main results, and
  - the conclusions or implications of the results.
- **Past tense** because refers to work done.
- **No references**.
- Self contained (published by itself).
- All the information contained in the abstract must be discussed in the main body of the report.

How to prepare the Introduction?

- You need to let the readers of your report know why the report is important and what exactly the report is about.
- Write the introduction after you have dealt with your method and results section.
- The introduction ends with a statement of your specific hypothesis or hypotheses.

How to prepare the Introduction?

- **Structure**

How to prepare the Introduction?

- **The literature needs to provide the reader/marker of your report with:**
  - **an understanding of the concept and theoretical background, and justification for the research you are undertaking;**
  - **an appreciation of the significance of this area and in particular your topic.**
- **It needs to provide a critical analysis of previous work.**

How to prepare the Introduction?

- Your literature review uses both the past tense and the present tense;
- **PAST tense:**

  The past tense is used to refer to a particular experiment and the specific results of a particular experiment that has been carried out in the past.

- **PRESENT tense:**

  The present tense is used to state your hypotheses.

How to prepare the Methods?

- **Purpose:** Describe method and materials used to conduct your experiment with enough detail .
- **Reproducibility** = basis of science.

  This section will often be broken down into **subsections**.
- **Past tense** since you are describing what you did.
- **If new method (unpublished):** provide all the needed details.
- **Avoid mistake:** No mixing some of the results.

Results

The Results section

- DESCRIBES but DOES NOT INTERPRET your research results.
- Presents the data using graphs and tables to reveal any trends that you found.
- The presentation of data may be in the order to correspond with the Methods.
- Negative results are results and worth including in your report.

How to write the Results?

- Result section = Core of the paper.
- No more method description.
- Not yet data interpretation: the discussion section is designed to tell what they mean.
- No references.
- All Figures are labeled and referenced in the text prior to the Figure.
- In the results section you will need to use both;
  - The past tense is used to describe results and analyses.

    Ex.: The results indicated
  - The present tense is used with results that the reader can see such as means, tables and figures.

    Ex.: Table 3 illustrates how ... .

Discussion

- What's the Discussion? Interpretation.
- Your discussion section has two fundamental aims:
  - to explain the results of your study,
  - to explore the significance of your study's findings.
- Therefore you need to:
  - Answer the questions raised in the introduction section;
  - show how your results relate to the literature;
  - outline any new research questions or areas for future research that your results have suggested.

Discussion

- **The discussion section requires you to use both the**
  - **The past tense is used when you need to explain particulars about your results.**

    Ex.: The activity increased with temperatures up to 37°C
  - **The present tense is used when you are expanding on the implications of your results or drawing conclusions.**

    Ex.: The results show ……

    This research provides …….

Conclusion

Synthesize, don't summarize:

- **Brief summary of the paper's main points.**
- **Do not simply repeat things that were in your paper.**
- **Show your reader how the points you made and the support and examples you used fit together.**
- **Pull it all together.**

How to write the Acknowledgments?

- **Acknowledge.**

  - **Advisors.**

  - **Your colleagues**

  - **Financial assistance (grants, fellowships, contractors, .).**

References

- If you reference an outside source in your report, you should cite where you found that source.
- Cite only material that you have actually read.
- Avoid secondary materials (only significant, published references).
- Read carefully "the instruction to authors" of the journal.
- Place it all at the point of the sentence

1. INTRODUCTION (Bold, font size 14 or 16)

1.1. Literature Review (Bold, font size 12 or 14)

Electrospinning is a method …….. (Text; font size 12 and double spaced)

1.1.1. History of Electrospinning (Bold, Italic, font size 12)

The process of using electrostatic forces ….. (Text; font size 12 and double spaced)

1.1.1.1. Parameters Affecting Fiber Diameter (Bold, Italic, font size 12)

Higher concentrations of polymer solution …….. (Text; font size 12 and double spaced)

1.2. Drug Delivery (Bold, font size 12 or 14)

Drug delivery is a process of …….. (Text; font size 12 and double spaced)

2. Experimental (Bold, font size 14 or 16)

2.1. Materials (Bold, font size 12 or 14)

Poly(vinyl alcohol) (PVA, Mw = ….) was …….. (Text; font size 12 and double spaced)

2.2. Characterization (Bold, font size 12 or 14)

FT- IR (model …..) was used to…….. (Text; font size 12 and double spaced)

2.3. Fabrication of PVA Nanofibers (Bold, font size 12 or 14)

Electrospinning of PVA…….. (Text; font size 12 and double spaced)

3. Results and Discussion (Bold, font size 14 or 16)

3.1. Fabrication of PVA Nanofibers (Bold, font size 12 or 14)

Electrospinning is a method …….. (Text; font size 12 and double spaced)

4. Conclusion (Bold, font size 14 or 16)

Electrospinning is a method …….. (Text; font size 12 and double spaced)

Acknowledgment (Bold, font size 14 or 16)

Electrospinning is a method …….. (Text; font size 12 and double spaced)

5. References (Bold, font size 14 or 16)

1) M. El-Newehy, S. Al-Deyab, E.-R. Kenawy, and A. Abdel-Megeed, *Fibers and Polymers*, 13(6). 709-717, (2012).