CAPÍTULO 4

EJEMPLO DE ANÁLISIS DE UN TEXTO

Presentamos a continuación el análisis completo del texto '*Sol-Gel Encapsulation Methods for Biosensors*' según nuestra aplicación del método de Michael Hoey (1991a) oración por oración junto con los enlaces que se establecen entre las unidades léxicas.

4. 1. Análisis del texto '*Sol-Gel Encapsulation Methods for Biosensors*'

Todos los textos han sido analizados de la misma forma que aquí se presenta y han sido revisados por el especialista en el contenido, Dr. Pedro Espinosa Hidalgo. Este texto no pertenece al artículo de investigación sino al de revisión. Fue el primero que analizamos antes de decidir en qué género se iba a realizar la investigación. Sin embargo, elegimos este texto para ejemplificar el modelo de análisis efectuado porque es representativo de los diversos tipos de enlaces.

Las unidades léxicas que establecen repetición aparecen enmarcadas en negro y unidas por medio de líneas de diversos colores para que sea más clara la identificación de los distintos tipos de repetición. Los siguientes colores representan los distintos tipos de repetición por orden de prioridad:

1. repetición simple.	(color naranja)
2. repetición compleja.	(color verde)
3. paráfrasis simple mutua / parcial.	(color rojo)
4. paráfrasis compleja (los tres tipos).	(color violeta)
5. sustitución.	(color azul)
6. co-referencia / hiponimia	(color turquesa)
7. elipsis.	(color gris)
8. deixis.	(color verde lima)
Relaciones establecidas por medio del triángulo.	- - - - - - - - -

4. 1. 1. Enlaces entre oración 1 y 18.

1. By nature, many biological macromolecules are highly efficient at recognizing specific analytes or catalyzing reactions in aqueous biological media.

2. These characteristics make biomolecules desirable reagents, but the aqueous medium that is almost always necessary for biomolecular reactions limits their commercial viability.

3. Drastic changes in the preferred buffered aqueous medium often lead to partial or total denaturation and loss of reactivity.

4. Efforts are being made to harness the utility of these reagents in biosensors by immobilizing them in alternative environments that stabilize them and preserve their reactivities.

5. Currently, biosensors are being used primarily in clinical testing, but the potential application of biosensors as in situ probes in industrial process monitoring and control appears promising.

6. The quintessential biosensor consists of an immobilized biomolecule that binds or otherwise reacts with a specific analyte, coupled with some type of signal transducer.

7. Optimum biosensor design requires maximum retention of biomolecular reactivity as well as efficient,[1] cost-effective signal transduction.

[1] **Efficient** (1) y **efficient** (7) establecen una relación de repetición simple dudosa. Es por lo que se utiliza una línea color naranja quebrada. **Efficient** en la oración 1 se refiere a 'macromolecules' y **efficient** (7) a 'signal transduction', pero 'signal transduction' está producida por 'macromolecules'.

1. By nature, many biological macromolecules [2] are highly efficient at recognizing specific analytes or catalyzing reactions in aqueous biological media.

8. One general area of biosensor research is the immobilization of enzymes or other proteins.

9. The major advantages of protein immobilization are close control of the reaction medium and conditions, prevention of bacterial and chemical degradation, cost-effective reusability of the protein, and enhanced biomolecular stability.

10. However, proteins often fail to retain their native [3] stabilities and reactivities upon immobilization, a flaw that results in low stabilities or altered functional responses of biosensors incorporating them.

11. Conventional methods of enzyme immobilization include covalent binding, physical adsorption, or cross-linking to a suitable carrier matrix.

12. Alternatively, enzymes can be physically entrapped and microencapsulated in polymeric matrices.

[2] Las relaciones triangulares de **macromolecules** (oración 1) con **biomolecular** (7), **enzymes or other proteins** (8), **protein** (9) y **enzyme** (11) aparecen explicadas en el epígrafe 3. 1. 1. 1.

[3] **Native** (10) y **nature** (1) están relacionadas por la unidad intermedia que no aparece en el texto ‘natural’, ya que establece una relación de paráfrasis simple con **native** (10) y a su vez es una repetición compleja de **nature** (1).

1. By nature, many biological macromolecules are highly efficient at recognizing specific analytes or catalyzing reactions in aqueous biological media.

13. For optimum biostability and reaction efficiency, the preferred host matrix appears to be one that isolates the biomolecule, protecting it from self-aggregation and microbial attack, while providing essentially the same local aqueous microenvironment as in biological media.

14. Recent research has demonstrated that silicate glasses obtained by the sol-gel method can provide such a host matrix and that biomolecules immobilized by this method retain their functional characteristics to a large extent.

15. Moreover, these functionalized glasses can be prepared so that they are optically transparent, permitting optical monitoring of the spectroscopic properties of the encapsulated biomolecules .

16. These biofunctional glasses make it possible to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

1. By nature, many biological macromolecules are highly efficient at recognizing specific analytes or catalyzing reactions in aqueous biological media.

17. Furthermore, the amorphous nature [4] of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

[4] La relación de repetición simple entre **nature** (1) y **nature** (17) es dudosa y por eso se utiliza una línea quebrada naranja. En la oración 1 se refiere a 'macromolecules' y en la 17 se refiere a 'material', pero éste es el que permite retener las características de 'macromolecules'.

4. 1. 1. 1. Relación triangular entre ‘macromolecules’, ‘biomolecules’, ‘biomolecular’, ‘enzymes’, y ‘proteins’.

1. By nature, many biological macromolecules are highly efficient at recognizing specific analytes or catalyzing reactions in aqueous biological media.
2. These characteristics make biomolecules desirable reagents, but the aqueous medium that is almost always necessary for biomolecular reactions limits their commercial viability.
7. Optimum biosensor design requires maximum retention of biomolecular reactivity as well as efficient, cost-effective signal transduction.
9. The major advantages of protein immobilization are close control of the reaction medium and conditions, prevention of bacterial and chemical degradation, cost-effective reusability of the protein, and enhanced biomolecular stability.
11. Conventional methods of enzyme immobilization include covalent binding, physical adsorption, or cross-linking to a suitable carrier matrix.
13. For optimum biostability and reaction efficiency, the preferred host matrix appears to be one that isolates the biomolecule, protecting it from self-aggregation and…

- <u>Relación triangular entre **macromolecules** (1) y **protein** (9)</u>. En la oración 9 **protein** está relacionada con **biomolecule** (13) por hiponimia. A su vez **macromolecules** (1) y **biomolecules** (13) están relacionadas por una repetición compleja, por lo tanto **protein** (9) y **macromolecules** (1) establecerán una relación triangular.

- <u>Relación triangular entre **macromolecules** (1) y **enzyme** (11)</u>. En la oración 11 **enzyme** está relacionada por hiponimia con **biomolecule** (13) que a su vez establece una relación de repetición compleja con **macromolecules** (1). Por lo tanto, **enzyme** (11) y **macromolecules** (1) están relacionadas mediante el triángulo.

- <u>Relación triangular entre **biomolecules** (2) y **protein** (9) y **biomolecules** (2) y **enzyme** (11)</u>. Las unidades léxicas **protein** (9) y **enzyme** (11) están relacionadas con **biomolecule** (13) por hiponimia. **Biomolecules** (2) y **biomolecule** (13) establecen una relación de repetición simple. Por lo tanto, **protein** (9) y **enzyme** (11) están relacionadas con **biomolecules** (2) por medio del triángulo.

- Relación triangular entre **biomolecular** (7) y **protein** (9) y **biomolecular** (7) y **enzyme** (11). Las unidades léxicas **protein** (9) y **enzyme** (11) están relacionadas con **biomolecule** (13) por hiponimia. **Biomolecular** (7) y **biomolecule** (13) establecen una relación de repetición compleja. Por lo tanto, **protein** (9) y **enzyme** (11) están relacionadas con **biomolecular** (7) por medio del triángulo.

- Relación triangular entre **protein** (9) y **enzyme** (11). Estas dos unidades están relacionadas con **biomolecule** (13) por hiponimia. Esta relación establece a su vez una relación triangular entre ambas.

4. 1. 2. Enlaces entre oración 2 y 18.

2. These characteristics make biomolecules desirable reagents, but the aqueous medium that is almost always necessary for biomolecular reactions limits their commercial viability.

3. Drastic changes in the preferred buffered aqueous medium often lead to partial or total denaturation and loss of reactivity.

4. Efforts are being made [5] to harness the utility of these reagents in biosensors by immobilizing them in alternative environments that stabilize them and preserve their reactivities .

5. Currently, biosensors are being used primarily in clinical testing, but the potential application of biosensors as in situ probes in industrial process monitoring and control appears promising.

6. The quintessential biosensor consists of an immobilized biomolecule that binds or otherwise reacts with a specific analyte, coupled with some type of signal transducer.

7. Optimum biosensor design requires maximum retention of biomolecular reactivity as well as efficient, cost-effective signal transduction.

8. One general area of biosensor research is the immobilization of enzymes or other proteins.

[5] **Made** (4) y **make** (2) no están relacionadas, ya que el significado de las dos unidades léxicas no es el mismo: **make** (2) = 'cause to be' / **made** (4) = 'perform'.

2. These characteristics make biomolecules desirable reagents, but the aqueous medium that is almost always necessary for biomolecular reactions limits their commercial viability.

9. The major advantages of protein immobilization are close control of the reaction medium and conditions, prevention of bacterial and chemical degradation, cost-effective reusability of the protein, and enhanced biomolecular stability.

10. However, proteins often fail to retain their native stabilities and reactivities upon immobilization, a flaw that results in low stabilities or altered functional responses of biosensors incorporating them.

11. Conventional methods of enzyme immobilization include covalent binding, physical adsorption, or cross-linking to a suitable carrier matrix.

12. Alternatively, enzymes can be physically entrapped and microencapsulated in polymeric matrices.

13. For optimum biostability and reaction efficiency, the preferred host matrix appears to be one that isolates the biomolecule, protecting it from self-aggregation and microbial attack, while providing essentially the same local aqueous microenvironment as in biological media.

14. Recent research has demonstrated that silicate glasses obtained by the sol-gel method can provide such a host matrix and that biomolecules immobilized by this method retain their functional characteristics to a large extent.

2. These characteristics make biomolecules desirable reagents, but the aqueous medium that is almost always necessary for biomolecular reactions limits their commercial viability.

15. Moreover, these functionalized glasses can be prepared so that they are optically transparent, permitting optical monitoring of the spectroscopic properties [6] of the encapsulated biomolecules.

16. These biofunctional glasses make it possible to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

17. Furthermore, the amorphous nature of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

[6] **Characteristics** en la oración 2 se refiere a 'biomolecules', mientras que en la oración 17 se refiere a 'liquid state', que es el que atrapa a 'biomolecules'. Por esta razón, la relación está marcada como dudosa.

4. 1. 3. Enlaces entre oración 3 y 18.

3. Drastic changes in the preferred buffered aqueous medium often lead to partial or total denaturation [7] and loss [8] of reactivity.

4. Efforts are being made to harness the utility of these reagents in biosensors by immobilizing them in alternative environments that stabilize them and preserve their reactivities.

5. Currently, biosensors are being used primarily in clinical testing, but the potential application of biosensors as in situ probes in industrial process monitoring and control appears promising.

6. The quintessential biosensor consists of an immobilized biomolecule that binds or otherwise reacts with a specific analyte, coupled with some type of signal transducer.

7. Optimum biosensor design requires maximum retention of biomolecular reactivity as well as efficient, cost-effective signal transduction.

8. One general area of biosensor research is the immobilization of enzymes or other proteins.

9. The major advantages of protein immobilization are close control of the reaction medium and conditions, prevention of bacterial and chemical degradation, cost-effective reusability of the protein, and enhanced biomolecular stability.

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[7] **Denaturation** (3) y **stabilize** (4) establecen una paráfrasis compleja. La unidad intermedia, **stability**, está presente en el texto, en la oración 9. **Stability** es antónima de **denaturation** (3) y a su vez establece una repetición compleja con **stablize** (4).

[8] **Loss** (3) y **preserve** (4) establecen una paráfrasis compleja. La unidad intermedia, que no está presente en el texto, es **preservation**, que establece una antonimia con **loss** (3) y a su vez una repetición compleja con **preserve** (4).

3. Drastic changes in the preferred buffered aqueous medium often lead to partial or total denaturation[9] and loss[10] of reactivity.

10. However, proteins often fail to retain their native stabilities and reactivities upon immobilization, a flaw that results in low stabilities or altered functional responses of biosensors incorporating them.

11. Conventional methods of enzyme immobilization include covalent binding, physical adsorption, or cross-linking to a suitable carrier matrix.

12. Alternatively, enzymes can be physically entrapped and microencapsulated in polymeric matrices .

13. For optimum biostability and reaction efficiency, the preferred host matrix appears to be one that isolates the biomolecule, protecting it from self-aggregation and microbial attack, while providing essentially the same local aqueous microenvironment as in biological media.

14. Recent research has demonstrated that silicate glasses obtained by the sol-gel method can provide such a host matrix and that biomolecules immobilized by this method retain their functional characteristics to a large extent.

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[9] **Denaturation** (3) y **biostability** (13) establecen una relación de paráfrasis compleja. La unidad intermedia presente en el texto es **stability** (9), que establece una antonimia con **denaturation** (3) y una repetición compleja con **biostability** (13).

[10] **Loss** (3) y **retain** (14) establecen una paráfrasis compleja. La unidad intermedia que aparece en el texto es **retention** (7), que establece una antonimia con **loss** (3) y una repetición compleja con **retain** (14).

3. Drastic changes in the preferred buffered aqueous medium often lead to partial or total denaturation and loss of reactivity.

15. Moreover, these functionalized glasses can be prepared so that they are optically transparent, permitting optical monitoring of the spectroscopic properties of the encapsulated biomolecules.

16. These biofunctional glasses make it possible to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

17. Furthermore, the amorphous nature of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

4. 1. 4. Enlaces entre oración 4 y 18.

4. Efforts are being made to harness the utility [11] of these reagents in biosensors by immobilizing them in alternative environments that stabilize them and preserve [12] their reactivities .

5. Currently, biosensors are being used primarily in clinical testing, but the potential application of biosensors as in situ probes in industrial process monitoring and control appears promising.

6. The quintessential biosensor consists of an immobilized biomolecule that binds or otherwise reacts with a specific analyte, coupled with some type of signal transducer.

7. Optimum biosensor design requires maximum retention of biomolecular reactivity as well as efficient, cost-effective signal transduction.

8. One general area of biosensor research is the immobilization of enzymes or other proteins.

9. The major advantages of protein immobilization are close control of the reaction medium and conditions, prevention of bacterial and chemical degradation, cost-effective reusability of the protein, and enhanced biomolecular stability.

[11] **Utility** (4) y **used** (5) establecen una paráfrasis compleja. La unidad intermedia, no presente en el texto, es **utilized**, que establece una sinonimia con **used** (5) y una repetición compleja con **utility** (4). Esta relación es dudosa y por eso se utiliza línea quebrada. **Utility** (4) se refiere a 'reagents' y **used** (5) a 'biosensors', que son los que utilizan los 'reagents'.

[12] La unidad intermedia que permite establecer una paráfrasis compleja entre **preserve** (4) y **retention** (7) es **retain**, que aparece en la oración 10.

4. Efforts are being made to harness the utility of these reagents in biosensors by immobilizing them in alternative environments [13] that stabilize them and preserve their reactivities.

10. However, proteins often fail to retain their native stabilities and reactivities upon immobilization, a flaw that results in low stabilities or altered functional responses of biosensors incorporating them.

11. Conventional methods of enzyme immobilization include covalent binding, physical adsorption, or cross-linking to a suitable carrier matrix.

12. Alternatively, enzymes can be physically entrapped and microencapsulated in polymeric matrices.

13. For optimum biostability and reaction efficiency, the preferred host matrix appears to be one that isolates the biomolecule, protecting it from self-aggregation and microbial attack, while providing essentially the same local aqueous microenvironment as in biological media.

14. Recent research has demonstrated that silicate glasses obtained by the sol-gel method can provide such a host matrix and that biomolecules immobilized by this method retain their functional characteristics to a large extent.

[13] **Environments** (4) está relacionada con dos unidades léxicas de la oración 13: **microenvironment** (repetición compleja) y **media** (sinonimia). Por el criterio de prioridad estableceremos la relación de repetición compleja.

4. Efforts are being made to harness the utility of these reagents in biosensors by immobilizing them in alternative environments that stabilize them and preserve their reactivities .

15. Moreover, these functionalized glasses can be prepared so that they are optically transparent, permitting optical monitoring of the spectroscopic properties of the encapsulated biomolecules .

16. These biofunctional glasses make it possible to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

17. Furthermore, the amorphous nature of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

4. 1. 5. Enlaces entre oración 5 y 18.

5. Currently, biosensors are being used primarily in clinical testing, but the potential application of biosensors as in situ probes in industrial process monitoring and control appears promising.

6. The quintessential biosensor consists of an immobilized biomolecule that binds or otherwise reacts with a specific analyte, coupled with some type of signal transducer.

7. Optimum biosensor design requires maximum retention of biomolecular reactivity as well as efficient, cost-effective signal transduction.

8. One general area of biosensor research is the immobilization of enzymes or other proteins.

9. The major advantages of protein immobilization are close control of the reaction medium and conditions, prevention of bacterial and chemical degradation, cost-effective reusability of the protein, and enhanced biomolecular stability.

10. However, proteins often fail to retain their native stabilities and reactivities upon immobilization, a flaw that results in low stabilities or altered functional responses of biosensors incorporating them.

11. Conventional methods of enzyme immobilization include covalent binding, physical adsorption, or cross-linking to a suitable carrier matrix.

12. Alternatively, enzymes can be physically entrapped and microencapsulated in polymeric matrices.

5. Currently, biosensors are being used primarily in clinical testing, but the potential application of biosensors as in situ probes in industrial process monitoring and control appears promising.

13. For optimum biostability and reaction efficiency, the preferred host matrix appears to be one that isolates the biomolecule, protecting it from self-aggregation and microbial attack, while providing essentially the same local aqueous microenvironment as in biological media.

14. Recent research has demonstrated that silicate glasses obtained by the sol-gel method can provide such a host matrix and that biomolecules immobilized by this method retain their functional characteristics to a large extent.

15. Moreover, these functionalized glasses can be prepared so that they are optically transparent, permitting optical monitoring of the spectroscopic properties of the encapsulated biomolecules.

16. These biofunctional glasses make it possible to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

17. Furthermore, the amorphous nature of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

4. 1. 6. Enlaces entre oración 6 y 18.

6. The quintessential biosensor consists of an immobilized biomolecule that binds or otherwise reacts with a specific analyte, coupled with some type of signal transducer.

7. Optimum biosensor design requires maximum retention of biomolecular reactivity as well as efficient, cost-effective signal transduction.

8. One general area of biosensor research is the immobilization of enzymes or other proteins.

9. The major advantages of protein immobilization are close control of the reaction medium and conditions, prevention of bacterial and chemical degradation, cost-effective reusability of the protein, and enhanced biomolecular stability.

10. However, proteins often fail to retain their native stabilities and reactivities upon immobilization, a flaw that results in low stabilities or altered functional responses [14] of biosensors incorporating them.

11. Conventional methods of enzyme immobilization include covalent binding, physical adsorption, or cross-linking to a suitable carrier matrix.

[14] **Signal** (6) y **responses** (10) establecen una relación de sinonimia dudosa. **Signal** (6) la produce ‘transducer’, **responses** (10) ‘biosensors’, pero las dos son producidas por ‘biomolecule’.

6. The quintessential biosensor consists of an immobilized biomolecule that binds or otherwise reacts with a specific analyte, coupled with some type of signal transducer.

12. Alternatively, enzymes can be physically entrapped and microencapsulated in polymeric matrices.

13. For optimum biostability and reaction efficiency, the preferred host matrix appears to be one that isolates the biomolecule, protecting it from self-aggregation and microbial attack, while providing essentially the same local aqueous microenvironment as in biological media.

14. Recent research has demonstrated that silicate glasses obtained by the sol-gel method can provide such a host matrix and that biomolecules immobilized by this method retain their functional characteristics to a large extent.

15. Moreover, these functionalized glasses can be prepared so that they are optically transparent, permitting optical monitoring of the spectroscopic properties of the encapsulated biomolecules.

16. These biofunctional glasses make it possible to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

17. Furthermore, the amorphous nature of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

6. The quintessential biosensor consists of an immobilized biomolecule that binds or otherwise reacts with a specific analyte, coupled with some type of signal transducer.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

4. 1. 7. Enlaces entre oración 7 y 18.

7. Optimum biosensor design requires maximum retention of biomolecular reactivity as well as efficient, cost-effective signal transduction.

8. One general area of biosensor research is the immobilization of enzymes or other proteins.

9. The major advantages of protein immobilization are close control of the reaction medium and conditions, prevention of bacterial and chemical degradation, cost-effective reusability of the protein, and enhanced biomolecular stability.

10. However, proteins often fail to retain their native stabilities and reactivities upon immobilization, a flaw that results in low stabilities or altered functional responses of biosensors incorporating them.

11. Conventional methods of enzyme immobilization include covalent binding, physical adsorption, or cross-linking to a suitable carrier matrix.

12. Alternatively, enzymes can be physically entrapped and microencapsulated in polymeric matrices.

13. For optimum biostability and reaction efficiency, the preferred host matrix appears to be one that isolates the biomolecule, protecting it from self-aggregation and microbial attack, while providing essentially the same local aqueous microenvironment as in biological media.

7. Optimum biosensor design requires maximum retention of biomolecular reactivity as well as efficient, cost-effective signal transduction.

14. Recent research has demonstrated that silicate glasses obtained by the sol-gel method can provide such a host matrix and that biomolecules immobilized by this method retain their functional characteristics to a large extent.

15. Moreover, these functionalized glasses can be prepared so that they are optically transparent, permitting optical monitoring of the spectroscopic properties of the encapsulated biomolecules.

16. These biofunctional glasses make it possible to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

17. Furthermore, the amorphous nature of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

4. 1. 8. Enlaces entre oración 8 y 18.

8. One general area of biosensor research is the immobilization of enzymes or other proteins. [15]

9. The major advantages of protein immobilization are close control of the reaction medium and conditions, prevention of bacterial and chemical degradation, cost-effective reusability of the protein, and enhanced biomolecular stability.

10. However, proteins often fail to retain their native stabilities and reactivities upon immobilization, a flaw that results in low stabilities or altered functional responses of biosensors incorporating them.

11. Conventional methods of enzyme immobilization include covalent binding, physical adsorption, or cross-linking to a suitable carrier matrix.

12. Alternatively, enzymes can be physically entrapped and microencapsulated in polymeric matrices.

13. For optimum biostability and reaction efficiency, the preferred host matrix appears to be one that isolates the biomolecule, protecting it from self-aggregation and microbial attack, while providing essentially the same local aqueous microenvironment as in biological media.

[15] **Enzymes** y **proteins** (8) están relacionadas con **biomolecules** (13) por hiponimia, aunque se contabiliza sólo un enlace.

8. One general area of biosensor research is the immobilization of enzymes or other proteins.

14. Recent research has demonstrated that silicate glasses obtained by the sol-gel method can provide such a host matrix and that biomolecules immobilized by this method retain their functional characteristics to a large extent.

15. Moreover, these functionalized glasses can be prepared so that they are optically transparent, permitting optical monitoring of the spectroscopic properties of the encapsulated biomolecules.

16. These biofunctional glasses make it possible to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

17. Furthermore, the amorphous nature of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

4. 1. 9. Enlaces entre oración 9 y 18.

9. The major advantages of protein immobilization are close control of the reaction medium and conditions, prevention of bacterial and chemical degradation, cost-effective reusability of the protein, and enhanced biomolecular stability.

10. However, proteins often fail to retain their native stabilities and reactivities upon immobilization, a flaw that results in low stabilities or altered functional responses of biosensors incorporating them.

11. Conventional methods of enzyme immobilization include covalent binding, physical adsorption, or cross-linking to a suitable carrier matrix.

12. Alternatively, enzymes can be physically entrapped and microencapsulated in polymeric matrices.

13. For optimum biostability and reaction efficiency, the preferred host matrix appears to be one that isolates the biomolecule, protecting it from self-aggregation and microbial attack, while providing essentially the same local aqueous microenvironment as in biological media.

14. Recent research has demonstrated that silicate glasses obtained by the sol-gel method can provide such a host matrix and that biomolecules immobilized by this method retain their functional characteristics to a large extent.

9. The major advantages of protein immobilization are close control of the reaction medium and conditions, prevention of bacterial and chemical degradation, cost-effective reusability of the protein, and enhanced biomolecular stability.

15. Moreover, these functionalized glasses can be prepared so that they are optically transparent, permitting optical monitoring of the spectroscopic properties of the encapsulated biomolecules.

16. These biofunctional glasses make it possible to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

17. Furthermore, the amorphous nature of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

4. 1. 10. Enlaces entre oración 10 y 18.

10. However, proteins often fail to retain their native stabilities and reactivities upon immobilization, a flaw that results in low stabilities or altered functional[16] responses of biosensors incorporating them.

11. Conventional methods of enzyme immobilization include covalent binding, physical adsorption, or cross-linking to a suitable carrier matrix.

12. Alternatively, enzymes can be physically entrapped and microencapsulated in polymeric matrices.

13. For optimum biostability and reaction efficiency, the preferred host matrix appears to be one that isolates the biomolecule, protecting it from self-aggregation and microbial attack, while providing essentially the same local aqueous microenvironment as in biological media.

14. Recent research has demonstrated that silicate glasses obtained by the sol-gel method can provide such a host matrix and that biomolecules immobilized by this method retain their functional characteristics to a large extent.

15. Moreover, these functionalized glasses can be prepared so that they are optically transparent, permitting optical monitoring of the spectroscopic properties of the encapsulated biomolecules.

[16] La relación entre **functional** (10) y **functionalized** (15) es dudosa. Tienen distintos referentes, pero los ‘glasses’ contienen ‘biomolecules’.

10. However, proteins often fail to retain their native stabilities and reactivities upon immobilization, a flaw that results in low stabilities or altered functional [17] responses of biosensors incorporating them.

16. These biofunctional glasses make it possible [18] to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

17. Furthermore, the amorphous nature [19] of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

[17] La relación de repetición compleja entre **functional** (10) y **biofunctional** (16) es dudosa. Tienen distintos referentes, pero los ‘glasses’ contienen ‘proteins’

[18] La relación de antonimia entre **fail** (10) y **make it possible** (16) es dudosa. En la oración 10, **fail** se refiere a ‘proteins’ y **make it possible**, en la oración 16, se refiere a ‘biofunctional glasses’, que son los que permiten mantener la reactividad de las proteínas.

[19] La unidad intermedia que permite relacionar **native** (10) y **nature** (17) es ‘natural’, no presente en el texto y que establece una relación de repetición compleja con **nature** y a su vez una paráfrasis simple con **native**.

4. 1. 11. Enlaces entre oración 11 y 18.

11. Conventional methods of enzyme immobilization include covalent binding, physical adsorption, or cross-linking to a suitable carrier matrix.

12. Alternatively, enzymes can be physically entrapped and microencapsulated in polymeric matrices.

13. For optimum biostability and reaction efficiency, the preferred host matrix appears to be one that isolates the biomolecule, protecting it from self-aggregation and microbial attack, while providing essentially the same local aqueous microenvironment as in biological media.

14. Recent research has demonstrated that silicate glasses obtained by the sol-gel method can provide such a host matrix and that biomolecules immobilized by this method retain their functional characteristics to a large extent.

15. Moreover, these functionalized glasses can be prepared so that they are optically transparent, permitting optical monitoring of the spectroscopic properties of the encapsulated biomolecules .

16. These biofunctional glasses make it possible to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

11. Conventional methods of enzyme immobilization include covalent binding, physical adsorption, or cross-linking to a suitable carrier matrix.

17. Furthermore, the amorphous nature of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

4. 1. 12. Enlaces entre oración 12 y 18.

12. Alternatively, enzymes can be physically entrapped and microencapsulated in polymeric matrices .

13. For optimum biostability and reaction efficiency, the preferred host matrix appears to be one that isolates the biomolecule, protecting it from self-aggregation and microbial attack, while providing essentially the same local aqueous microenvironment as in biological media.

14. Recent research has demonstrated that silicate glasses obtained by the sol-gel method can provide such a host matrix and that biomolecules immobilized by this method retain their functional characteristics to a large extent.

15. Moreover, these functionalized glasses can be prepared so that they are optically transparent, permitting optical monitoring of the spectroscopic properties of the encapsulated biomolecules .

16. These biofunctional glasses make it possible to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

17. Furthermore, the amorphous nature of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

12. Alternatively, enzymes can be physically entrapped and microencapsulated in polymeric matrices .

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

4. 1. 13. Enlaces entre oración 13 y 18.

13. For optimum biostability and reaction efficiency, the preferred host matrix appears to be one that isolates the biomolecule, protecting it from self-aggregation and microbial attack, while providing essentially the same local aqueous microenvironment as in biological media.

14. Recent research has demonstrated that silicate glasses obtained by the sol-gel method can provide such a host matrix and that biomolecules immobilized by this method retain their functional characteristics to a large extent.

15. Moreover, these functionalized glasses can be prepared so that they are optically transparent, permitting optical monitoring of the spectroscopic properties of the encapsulated biomolecules .

16. These biofunctional glasses make it possible to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

17. Furthermore, the amorphous nature of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

13. For optimum biostability and reaction efficiency, the preferred host matrix appears to be one that isolates the biomolecule, protecting it from self-aggregation and microbial attack, while providing essentially the same local aqueous microenvironment as in biological media.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

4. 1. 14. Enlaces entre oración 14 y 18.

14. Recent research has demonstrated that silicate glasses obtained by the sol-gel method can provide such a host matrix and that biomolecules immobilized by this method retain their functional characteristics to a large extent.

15. Moreover, these functionalized glasses can be prepared so that they are optically transparent, permitting optical monitoring of the spectroscopic properties of the encapsulated biomolecules .

16. These biofunctional glasses make it possible to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

17. Furthermore, the amorphous nature of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

4. 1. 15. Enlaces entre oración 15 y 18.

15. Moreover, these functionalized glasses can be prepared so that they are optically transparent, permitting optical monitoring of the spectroscopic properties of the encapsulated [20] biomolecules.

16. These biofunctional glasses make it possible to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

17. Furthermore, the amorphous nature of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

[20] La unidad intermedia que permite relacionar **encapsulated** (15) y **entrapment** (18) es **entrapped**, presente en la oración 17 y que establece una relación de repetición compleja con **entrapment** y una paráfrasis simple con **encapsulated**.

4. 1. 16. Enlaces entre oración 16 y 18.

16. These biofunctional glasses make it possible to retain the specificity and reactivity of biological molecules in the solid state and provide morphological and structural control that is not available when the biological molecules are simply dissolved in aqueous media.

17. Furthermore, the amorphous nature of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

4. 1. 17. Enlaces entre oración 17 y 18.

17. Furthermore, the amorphous nature of the glassy material does not impart a geometric order to the entrapped molecules; many of the characteristics of the liquid state are retained despite the fact that the molecule is trapped in a solid material.

18. In this article we review recent advances in sol-gel entrapment of biorecognition molecules in these transparent porous silicate matrices and discuss their potential use as optically based sensor elements.

4. 2. Matriz de repetición con las unidades léxicas.

Una vez realizado el análisis detallado y minucioso de las relaciones de repetición que establecen las unidades léxicas entre oraciones, estas unidades léxicas se presentan en forma de matriz. Las celdas verticales presentan todas las unidades léxicas que una oración establece con las oraciones posteriores, mientras que las celdas horizontales presentan las relaciones entre las unidades léxicas que una oración establece con las anteriores.

Debido a lo extenso que sería presentar el análisis de relaciones entre oraciones tal y como se ha efectuado en este capítulo – observemos que este texto con sólo 18 oraciones ocupa 39 páginas – optamos por presentar, en el anexo, la matriz de cada uno de los textos analizados; de esta forma, se puede observar no sólo la cantidad de enlaces sino también el tipo de enlaces que cada oración establece con otra.

El color negro indica la oración y la unidad léxica anterior y el rojo la oración y unidad léxica posterior. Así, en la primera celda de la matriz, **macromolecules**, y **1** en negro nos indica que está relacionada con **biomolecules** en la oración **2** ambas en rojo. Las unidades léxicas están ordenadas según el orden de aparición en la oración anterior, que se toma de referencia.

No sólo se presentan las unidades léxicas que establecen relaciones, sino también el tipo de enlace que establecen. Las abreviaturas utilizadas por orden de prioridad son las siguientes:

- **rs**. repetición simple.
  Ej. **reactions** (oración 1) – **reactions** (oración 2).
- **rc**. repetición compleja.
  Ej. **reactions** (oración 1) – **reactivity** (oración 3).
- **psm**. paráfrasis simple mutua.
  Ej. **media** (oración 1) – **environments** (oración 4).
- **psp**. paráfrasis simple parcial.
  Ej. **signal** (oración 6) – **responses** (oración 10).
- **a**. paráfrasis compleja de antonimia.
  Ej. **denaturation** (oración 3) – **stability** (oración 9).
- **pc**. paráfrasis compleja. Bajo el término paráfrasis compleja (**pc**) incluiremos a las unidades léxicas que se relacionan mediante una unidad intermedia que

establezca una repetición compleja y a su vez una paráfrasis simple o antonimia, tanto si esta unidad intermedia aparece en el texto como si no está presente en el mismo.

Un ejemplo de unidad intermedia presente en el texto y que establece una relación de paráfrasis simple sería **entrapped** en la oración 17 que nos permite relacionar **encapsulated** en la oración 15 con **entrapment** en la oración 18, ya que esta unidad intermedia, **entrapped**, establece una relación de repetición compleja con **entrapment** y a su vez una paráfrasis simple con **encapsulated**.

Un ejemplo de unidad intermedia que no está presente en el texto y que establece una relación de paráfrasis simple sería **utilized**, que nos permite relacionar **utility** en la oración 4 con **used** en la oración 5.

Un ejemplo de unidad intermedia presente en el texto y que establece una relación de antonimia sería **retain** en la oración 10 que nos permite establecer una relación de paráfrasis compleja de antonimia entre **preserve** en la oración 4 y **retention** en la oración 7.

Un ejemplo de unidad intermedia no presente en el texto y que establece una relación d antonimia sería **preservation**, que nos permite relacionar **loss** en la oración 3 con **preserve** en la oración 4. Estas unidades léxicas intermedias, tanto si están presentes en el texto como si no, aparecen en la matriz en negrita junto a las unidades léxicas que relacionan.

- **s**. sustitución.
  Ej. **biomolecules** (oración 2) **–** **them** (oración 4).
- **hip**. hiponimia.
  Ej. **protein** (oración 9) **–** **molecules** (oración 18).
- **e**. elipsis. Este texto no presenta ningún tipo de enlace mediante la elipsis.
- **d**. deixis.
  Ej. **highly efficient..... biological media** (oración 1) **–** **these** (oración 2).
- **tr**. aquellas relaciones que se establecen por medio del triángulo.
  Ej. **macromolecules** (oración 1) **–** **encimes** (oración 12).
- * relaciones dudosas con respecto al criterio.
  Ej. **efficient** (oración 1) **–** **efficient** (oración 7).
- + relaciones dudosas externas al texto.

	1	2	3	4	5
2	**rc**. macromolecules – biomolecules **d**. highly efficient... biological media – these **rs**. reactions – reactions **rs**. aqueous – aqueous **rs**. media – medium				
3	**rc**. reactions – reactivity **rs**. aqueous – aqueous **rs**. media – medium	**rs**. aqueous – aqueous **rs**. medium – medium **rc**. reactions – reactivity			
4	**rc**. reactions – reactivities **psm**. media – environments	**s**. biomolecules – them **rs**. reagents – reagents **psm**. medium – environments **rc**. reactions – reactivities	**psm**. medium – environments **pc**. denaturation – stabilize (**stability**) **pc**. loss – preserve (**preservation**) **rs**. reactivity – reactivities		
5				**pc**. utility – used* (**utilized**) **rs**. biosensors – biosensors	
6	**rc**. macromolecules – biomolecule **rs**. specific – specific **rs**. analytes – analyte **rc**. reactions – reacts	**rs**. biomolecules – biomolecule **rc**. reactions – reacts	**rc**. reactivity – reacts	**rs**. biosensors – biosensor **rs**. immobilizing – immobilized **rc**. reactivities – reacts	**rs**. biosensors – biosensor
7	**rc**. macromolecules – biomolecular **rs**. efficient – efficient* **rc**. reactions – reactivity	**psm**. is..... necessary – requires **rs**. biomolecular – biomolecular **rc**. reactions – reactivity	**a**. loss – retention **rs**. reactivity – reactivity	**rs**. biosensors – biosensor **pc**. preserve – retention (**retain**) **rs**. reactivities – reactivity	**rs**. biosensors – biosensor
8	**tr**. macromolecules – enzymes or other proteins	**tr**. biomolecules – enzymes or other proteins		**rs**. biosensors – biosensor **rc**. immobilizing – immobilization	**rs**. biosensors – biosensor
9	**tr**. macromolecules – protein **rs**. reactions – reaction **rs**. media – médium	**tr**. biomolecules – protein **rs**. medium – medium **rs**. biomolecular – biomolecular **rs**. reactions – reaction	**rs**. medium – medium **a**. denaturation – stability **rc**. reactivity – reaction	**rc**. immobilizing – immobilization **psm**. environments – medium **rc**. stabilize – stability **rc**. reactivities – reaction	

	1	2	3	4	5
10	**pc**. nature – native (**natural**) **tr**. macromolecules – proteins. **a**. are highly efficient – fail **rc**. reactions – reactivities	**tr**. biomolecules – proteins **rc**. reactions – reactivities	**psm**. lead to – results in **a**. denaturation – stabilities **rs**. reactivity – reactivities	**rs**. biosensors – biosensors **rc**. immobilizing – immobilization **rs**. them – them **rc**. stabilize – stabilities **psm**.. preserve – retain **rs**. reactivities – reactivities	**rs**. biosensors – biosensors
11	**tr**. macromolecules – enzyme	**tr**. biomolecules – enzyme		**rc**. immobilizing – immobilization	
12	**tr**. macromolecules – enzymes	**tr**. biomolecules – enzymes			
13	**rc**. macromolecules – biomolecule **rc**. efficient – efficiency **rs**. reactions – reaction **rs**. aqueous – aqueous **rs**. biological – biological **rs**. media – media	**rs**. biomolecules – biomolecule **rs**. aqueous – aqueous **rs**. medium – media **rs**. reactions – reaction	**rs**. preferred – preferred **rs**. aqueous – aqueous **rs**. medium – media **pc**. denaturation – biostability (**stability**) **rc**. reactivity – reaction	**rc**. environments – microenvironments **rc**. stabilize – biostability **rc**. reactivities – reaction	
14	**rc**. macromolecules – biomolecules	**rs**. biomolecules – biomolecules **rs**. characteristics – characteristics	**pc**. loss – retain **(retention)**	**rs**. immobilizing – immobilized **psm**. preserve – retain	
15	**rc**. macromolecules – biomolecules	**psm** characteristics – properties **rs**. biomolecules – biomolecules			
16	**rs**. biological – biological **rc**. macromolecules – molecules **rc**. reactions – reactivity **rs**. aqueous – aqueous **rs**. media – media	**rc**. biomolecules – molecules **rs**. aqueous – aqueous **rs**. medium – media **rc**. reactions – reactivity	**rs**. aqueous – aqueous **rs**. medium – media **pc**. loss – retain (**retention**) **rs**. reactivity – reactivity	**psm**. environments – media **psm**. preserve – retain **rs**. reactivities – reactivity	
17	**rs**. nature – nature* **rc**. macromolecules – molecules	**rs**. characteristics – characteristics* **rc**. biomolecules – molecules	**pc**. loss – retained (**retention**)	**psm**. preserve – retained	
18	**rc**. macromolecules – molecules **rc**. recognizing – biorecognition	**rc**. biomolecules – molecules		**psm**. utility – use	**rs**. potential – potential **rc**. used – use

	6	7	8	9	10
7	**psm**. quintessential – optimum **rs**. biosensor – biosensor **rc**. biomolecule – biomolecular **rc**. reacts – reactivity **rs**. signal – signal **rc**. transducer – transduction				
8	**rs**. biosensor – biosensor **rc**. immobilized – immobilization **tr**. biomolecule – enzyme or..proteins	**rs**. biosensor – biosensor **tr**. biomolecular – enzymes or .. proteins			
9	**rc**. immobilized – immobilization **rc**. biomolecule – biomolecular **rc**. reacts – reaction	**rs**. biomolecular – biomolecular **rc**. reactivity – reaction **rs**. cost-effective – cost- effective	**rs**. immobilization – immobilization **rs**. proteins – protein		
10	**rs**. biosensor – biosensors **rc**. immobilized – immobilization **tr**. biomolecule – proteins **rc**. reacts – reactivities **psp**. signal – responses*	**rs**. biosensor – biosensors **rc**. retention – retain **tr**. biomolecular – proteins **rs**. reactivity – reactivities **psp**. signal – responses*	**rs**. biosensor – biosensors **rs**. immobilization – immobilization **rs**. proteins – proteins	**rs**. protein – proteins **rs** immobilization – immobilization **rc**. reaction – reactivities **rs**. stability – stabilities	
11	**psm**. consists of – include **rc**. immobilized – immobilization **tr**. biomolecule – enzyme **rs**. binds – binding	**tr**. biomolecular – enzyme	**rs**. immobilization – immobilization **rs**. enzymes – enzyme	**tr**. protein – enzyme **rs**. immobilization – immobilization	**tr**. proteins – enzyme **rs**. immobilization – immobilization
12	**tr**. biomolecule – enzymes	**tr**. biomolecular – enzymes	**rs**. enzymes – enzymes	**tr**. protein – enzymes	**tr**. proteins – enzymes
13	**rs**. biomolecule – biomolecule **rc**. reacts – reaction	**rs**. optimum – optimum **rc**. biomolecular – biomolecule **rc**. reactivity – reaction **rc**. efficient – efficiency	**hip**. enzymes or … proteins – biomolecule	**hip**. protein – biomolecule **rs**. reaction – reaction **rs**. medium – media **psm**. bacterial – microbial **rc**. stability – biostability	**hip**. proteins – biomolecule **rc**. stabilities – biostability **rc**. reactivities – reaction
14	**rs**. immobilized – immobilized **rs** biomolecule – biomolecules	**rc**. retention – retain **rc**. biomolecular – biomolecules	**rs**. research – research **rc**. immobilization – immobilized **hip**. enzymes or.. proteins – biomolecules	**hip**. protein – biomolecules **rc**. immobilization – immobilized	**hip**. proteins – biomolecules **rs**. retain – retain **rc**. immobilization – immobilized **rs**. functional – functional

	6	7	8	9	10
15	**rs**. biomolecule – biomolecules	**rc**. biomolecular – biomolecules	**hip**. enzymes or..proteins – biomolecules	**hip**. protein – biomolecules	**hip**. proteins – biomolecules **rc**. functional – functionalized*
16	**rc**. biomolecule – molecules **rc**. reacts – reactivity	**rc**. retention – retain **rc**. biomolecular – molecules **rs**. reactivity – reactivity	**hip**. enzymes or.. proteins – molecules	**hip**. protein – molecules **rs**. control – control **rc**. reaction – reactivity **rs**. medium – media	**hip**. proteins – molecules **a**. fail – make it possible* **rs**. retain – retain **rs**. reactivities – reactivity **rc**. functional – biofunctional*
17	**rc**. biomolecule – molecules	**rc**. retention – retained **rc**. biomolecular – molecules	**hip**. enzymes or..proteins – molecules	**hip**. protein – molecules	**hip**. proteins – molecules **rs**. retain – retained **pc**. native – nature (**natural**)
18	**rc**. biomolecule – molecules	**rc**. biomolecular – molecules	**hip**. enzymes or..proteins – molecules	**hip**. protein – molecules	**hip**. proteins – molecules

	11	12	13	14
12	**rs**. enzyme – enzymes **rs**. matrix – matrices			
13	**hip**. enzyme – biomolecule **rs**. matrix – matrix	**hip**. enzymes – biomolecule **rs**. matrices – matrix		
14	**a**. conventional – recent **rs**. methods – method **hip**. enzyme – biomolecules **rc**. immobilization – immobilized **rs**. matrix – matrix	**hip**. enzymes – biomolecules **rs**. matrices – matrix	**rs**. host – host **rs**. matrix – matrix **rs**. biomolecule – biomolecules **rs**. providing – provide	
15	**hip**. enzyme – biomolecules	**hip**. enzymes – biomolecules **rc**. microencapsulated – encapsulated	**rs**. biomolecule – biomolecules	**rs**. glasses – glasses **rs**. biomolecules – biomolecules **rc**. functional – functionalized * **psm**. characteristics – properties
16	**hip**. enzyme – molecules	**hip**. enzymes – molecules	**rc**. reaction – reactivity **rc**. biomolecule – molecules **rs**. providing – provide **rs**. aqueous – aqueous **rs**. media – media	**rs**. glasses – glasses **rs**. provide – provide **rc**. biomolecules – molecules **rs**. retain – retain **rc**. functional – biofunctional*
17	**hip**. enzyme – molecules **psp**. matrix – material	**hip**. enzymes – molecules **rs**. entrapped – entrapped **psp**. matrices – material	**rc**. biomolecule – molecules **psp**. providing – impart	**rc**. glasses – glassy **psp**. provide – impart **psp**. matrix – material **rc**. biomolecules – molecules **rs**. retain – retained **rs**. characteristics – characteristics*
18	**hip**. enzyme – molecules **rs**. matrix – matrices	**hip**. enzymes – molecules **rc**. entrapped – entrapment **rs**. matrices – matrices	**rs**. matrix – matrices **rc**. biomolecule – molecules	**rs**. silicate – silicate **rs**. sol-gel – sol-gel **rs**. matrix – matrices **rc**. biomolecules – molecules

	15	16	17
16	**rc**. functionalized – biofunctional **rs**. glasses – glasses **psm**. permitting – make it possible **rc**. biomolecules – molecules		
17	**rc**. glasses – glassy **psm**. properties – characteristics* **psm**. encapsulated – entrapped **rc**. biomolecules – molecules	**rc**. glasses – glassy **rs**. retain – retained **rs**. molecules – molecules **rs**. state – state **psp**. provide – impart	
18	**rs** optically – optically **rs**. transparent – transparent **pc**. encapsulated – entrapment (**entrapped**) **rc**. biomolecules – molecules	**rs**. molecules – molecules	**psp**. material – matrices **rc**. entrapped – entrapment **rs**. molecules – molecules

Esta matriz nos aporta una valiosa información de cómo el texto está estructurado mediante la cohesión, de cómo las oraciones bien próximas o lejanas están conectadas unas a otras. Las columnas verticales presentan los enlaces de una oración con las posteriores, mientras que las horizontales presentan los enlaces con las anteriores. Por ejemplo, la oración 6, en la columna vertical, muestra que establece 6 enlaces con la oración 7, 3 con la oración 8, 3 con la oración 9 y así sucesivamente. A su vez, la oración 6, en la columna horizontal, muestra que establece 4 enlaces con la oración 1, 2 con la oración 2, 1 con la oración 3, etc.

4. 3. Matriz con el número de unidades léxicas que establecen enlaces.

En esta matriz se presentan contabilizadas las unidades léxicas. El número entre paréntesis indica el número de unidades léxicas teniendo en cuenta los enlaces dudosos.

	1	2	3	4	5	6	7	8	9	10	11	12
2	5											
3	3	3										
4	2	4	4									
5	0	0	0	1(2)								
6	4	2	1	3	1							
7	2 (3)	3	2	3	1	6						
8	1	1	0	2	1	3	2					
9	3	4	3	4	0	3	3	2				
10	4	2	3	6	1	4(5)	4(5)	3	4			
11	1	1	0	1	0	4	1	2	2	2		
12	1	1	0	0	0	1	1	1	1	1	2	
13	6	4	5	3	0	2	4	1	5	3	2	2
14	1	2	1	2	0	2	2	3	2	4	5	2
15	1	2	0	0	0	1	1	1	1	1(2)	1	2
16	5	4	4	3	0	2	3	1	4	3(5)	1	1
17	1(2)	1(2)	1	1	0	1	2	1	1	2(3)	2	3
18	2	1	0	1	2	1	1	1	1	1	2	3

	13	14	15	16	17
14	4				
15	1	3(4)			
16	5	4(5)	4		
17	2	5(6)	3(4)	5	
18	2	4	4	1	3

Las celdas nos indican los enlaces ('links') que los pares de oraciones establecen entre sí. En esta matriz contabilizamos 153 celdas o pares de oraciones.

También se recoge el tanto por ciento de las oraciones que no establecen ningún enlace para la posible comparación entre los dos tipos de texto que hemos utilizado para nuestro análisis.

Volviendo a la matriz numérica, la proporción queda reflejada en la siguiente tabla:

Número de enlaces	**Número de celdas**	**Tanto por ciento**
0	18	11’7%
A partir de 3 (sin tener en cuenta los enlaces dudosos)	54	35’2%
A partir de 3 (teniendo en cuenta los enlaces dudosos)	56	36’6%
A partir de 4 (sin tener en cuenta los enlaces dudosos)	31	20’2%
A partir de 4 (teniendo en cuenta los enlaces dudosos)	36	22’2%
TOTAL	153	

Podemos observar en la tabla que, incluso teniendo en cuenta los enlaces dudosos, los pares de oraciones que establecen 3 enlaces supera el 30%; por lo tanto, tomaremos 4 enlaces como mínimo para establecer una conexión (‘bond’). En la matriz numérica sombrearemos en gris las celdas que contengan 4 o más enlaces y los dudosos los sombrearemos con rayas; de esta forma, podremos contabilizar a cuántas oraciones una oración determinada está conectada.

En la siguiente tabla se muestra el número de oraciones a las que una oración está conectada. A cada oración se le asignan entre paréntesis 2 datos numéricos, el primero se refiere al número de conexiones que una oración establece con las anteriores y el segundo al número de conexiones que la oración establece con las posteriores. Los datos numéricos del segundo paréntesis nos indican las conexiones que una oración establece con otra teniendo en cuenta los enlaces dudosos.

1. (- ,5) [**5**]
2. (1,4) [**5**]
3. (0,3) [**3**]
4. (2,2) [**4**]
5. (0,0) [**0**]
6. (1,3) [**4**]
7. (1,2) [**3**]
8. (0,0) [**0**]
9. (2,3) [**5**]
10. (5,1) (5,2) [**6**] [**7**]
11. (1,1) [**2**]
12. (0,0) [**0**]
13. (5,2) [**7**]
14. (3,3) (3,4) [**6**] [**7**]
15. (0,2) (1,3) [**2**] [**4**]
16. (7,1) (8,1) [**8**] [**9**]
17. (2,0) (3,0) [**2**] [**3**]
18. (2,-) [**2**]

Observando la matriz numérica, la oración 16, por ejemplo, está conectada con las oraciones anteriores 1, 2, 3, 9, 10 (de forma dudosa y sombreada a rayas), 13, 14 y 15 y con la oración posterior 17. En los datos numéricos del primer paréntesis queda recogido (7,1) y en el segundo paréntesis queda recogido (8,1).

En la siguiente tabla se muestra la cantidad de oraciones y la cantidad de conexiones del texto. En esta tabla no se tienen en cuenta los enlaces dudosos.

Nº Conexiones	**Nº Oraciones**
0	3
1	0
2	4
3	2
4	2
5	3
6	2
7	1
8	1

Las matrices de repetición y las tablas de todos los textos analizados se ofrecen en el anexo para la posible observación de la recogida de datos.