



Fibroin-based Hydrogel for Insulin

 drishtiias.com/printpdf/fibroin-based-hydrogel-for-insulin

Why in News

Recently, Scientists at Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), have developed an **injectable silk fibroin-based hydrogel (or iSFH)** for sustained **insulin delivery** in **diabetic** patients.

JNCASR is an autonomous research institute under the **Department of Science and Technology**.

Key Points

- **Diabetes:**

- It results from **inadequate production of insulin** due to loss of **beta cells** (found in pancreas, make insulin) **or insulin resistance** within the body.
Insulin helps glucose from food get into cells to be used for energy.
- The inadequate production of insulin does not convert glucose into energy which leads to an abrupt **increase of blood glucose level**.
- **India** is home to more than 70 million diabetes people, it is the second-highest in the world after China.

- **Treatment:**

The conventional and last resort of treatment involves **repeated subcutaneous insulin injections** to maintain the physiological glucose balance.

Subcutaneous means under the skin.

- **Issues in Treatment:**

The **multiple subcutaneous insulin** injections are associated with pain, local tissue necrosis (death of tissues), infection, nerve damage, and locally concentrated insulin amyloidosis responsible for inability to achieve physiological glucose balance.

Amyloidosis is a phenomenon that occurs when an abnormal protein, called amyloid, builds up in organs and interferes with their normal function.

- **One of the Solutions:** Controlled and sustained insulin delivery.

- **iSFH:** The **injectable Silk Fibroin Hydrogel (iSFH)** can **ease insulin delivery in diabetic patients.**

- The iSFH has successfully delivered active insulin in rats.
- The subcutaneous injection of insulin with-iSFH in diabetic rats formed an **active depot** under the skin from which **insulin trickled out slowly** and restored the physiological glucose balance for a prolonged period of 4 days.
- The **porous form of iSFH** allowed the **encapsulation** of **recombinant** insulin (identical to human insulin) in its active form in diabetic rats.
- It has proved to be an effective insulin delivery tool with excellent **mechanical strength, biocompatibility, encapsulation, storage**, and demonstration of its **sustained delivery of active insulin** in the diabetic animal.
- The **active encapsulation and delivery of insulin by iSFH** may also have implications for the future development of formulations for **oral insulin delivery.**

Silk Fibroin

- Silk fibroins are the unique **proteins of silkworm fibers.**
- Researchers have found fibroin as the **promising resources of biotechnology and biomedical materials.**
- They have unique properties which include **biocompatibility (i.e. compatible with living tissue), favorable oxygen permeability, and biodegradability.**
- The **degradation product also can be readily absorbed by the body** with minimal inflammatory reaction.

Hydrogel

A hydrogel is a three-dimensional network of **hydrophilic polymers** that can swell in water and hold a large amount of water while maintaining the structure due to chemical or physical cross-linking of individual polymer chains.

Source: PIB