

## METHODS FOR MAKING VASCULAR STENTS ANTITHROMBOGENIC

### Fields of use

Medical devices

### Current state of technology

Under development / lab tested

### Type of cooperation

Technical cooperation and license agreement

### Intellectual property

Patent(s) applied for but not yet granted

### Developed by

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### Summary

A Slovenian research institute offers technologies for surface treatment of titanium, nitinol (nickel-titanium alloy) and stainless-steel vascular stents. The developed methods reduce adhesion and activation of platelets on titanium and nitinol stents, thus preventing thrombosis as well as prevent release of toxic nickel. Producers of vascular stents and other medical devices are sought for technical cooperation and license agreement.

### Description of the invention

The major cause of mortality in the modern world is coronary artery disease. Stents are commonly employed to enlarge the lumen wall and to restore the blood flow through the affected blood vessel. Bare metal stents (BMS) are made of hemocompatible and durable material, such as titanium, nitinol (nickel-titanium alloy), stainless steel and cobaltchromium.

The problem: Although stents are used to improve blood flow, blood platelets adhere to untreated vascular stent surface which leads to the formation of a thrombus. The thrombus obstructs the flow of blood through the circulatory system and increases the risk of heart attack.

Nitinol stents contain nickel, a known allergenic carcinogen that exhibits one of the highest sensitivities in metallic allergen tests. Nickel is often detected on the surface of the nitinol stents, which represents a threat of nickel release in blood.

The solution: A Slovenian research institute has developed several methods for improving biocompatibility of bare metal stents. The methods have been developed for titanium stents, nitinol and stainless-steel stents.

Method for titanium stents involves nanostructuring of the surface of titanium by electrochemical anodization and subjecting the nanostructured surface to neutral oxygen atoms to eliminate surface induced thrombotic reactions.

Method for nitinol stents includes treatment with hydrogen plasma and neutral oxygen atoms. Two further methods for nitinol and stainless-steel stents have been developed.

All methods have been tested in laboratory using blood samples, where platelet adhesion was studied on plain titanium/nitinol and on surface modified by the methods. According to microscopic analysis of the samples treated by the developed methods the platelet adhesion is prevented, as practically no platelets were observed on the surfaces of stents treated by the methods. Additionally, toxic nickel release is prevented after the treatment of nitinol stent.

## Main Advantages

- The developed methods highly reduce adhesion and activation of platelets on the vascular stents, thus preventing formation of a thrombus, decreasing the risk of cardiovascular disease and heart attack
- The surface of titanium stent is free of impurities after treatment
- Nickel release from nitinol stent is prevented
- No environmentally problematic chemicals are used during treatment of stents
- The methods are applicable on bare metal stents (BMS) which are three to four times less expensive than drug-eluting stents (DES)

## Partner Sought

The Slovenian research institute is looking for producers of vascular stents, heart valves and similar medical devices. Technical cooperation agreement with companies that wish to validate the technology on their vascular stents/similar medical devices is sought. The Slovenian institute would test the methods on the stents/other medical devices, provided by the company. After the tests commercialization of the technology is foreseen by concluding license agreement.