

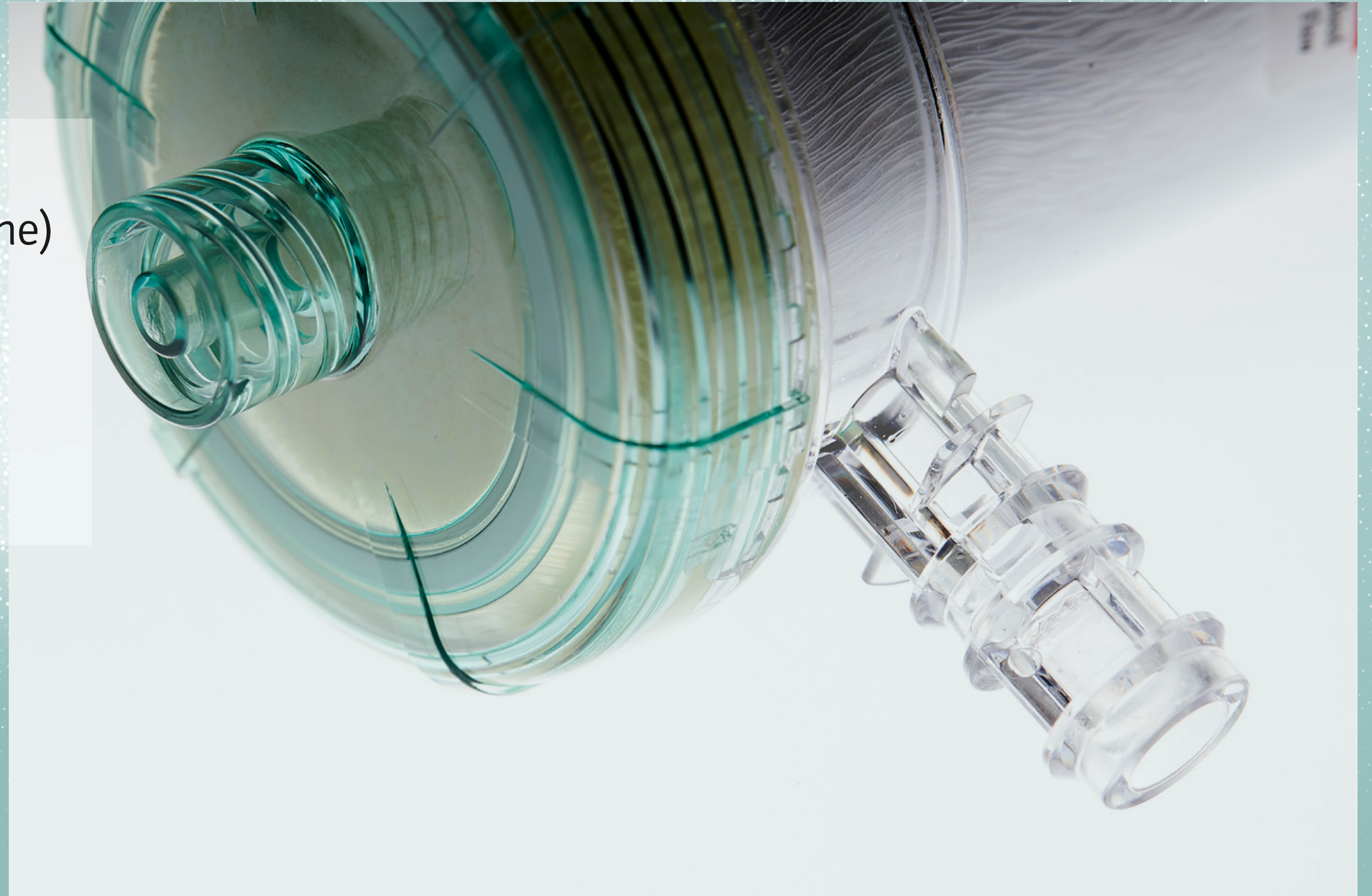
Polyvinylpyrrolidone (PVP)

A silent killer?



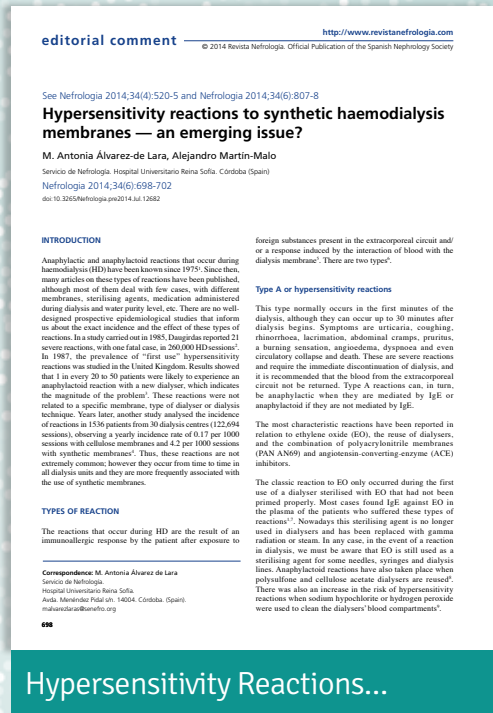
PVP: what is it?

Various poly (arylethersulfone)-based dialyzer membranes (PS, PES) use poly (N-vinyl-2-pyrrolidone) (PVP), which is responsible for **pore size building** during membrane manufacturing as well as improvement of the **hydrophilicity** of these kind of membranes.

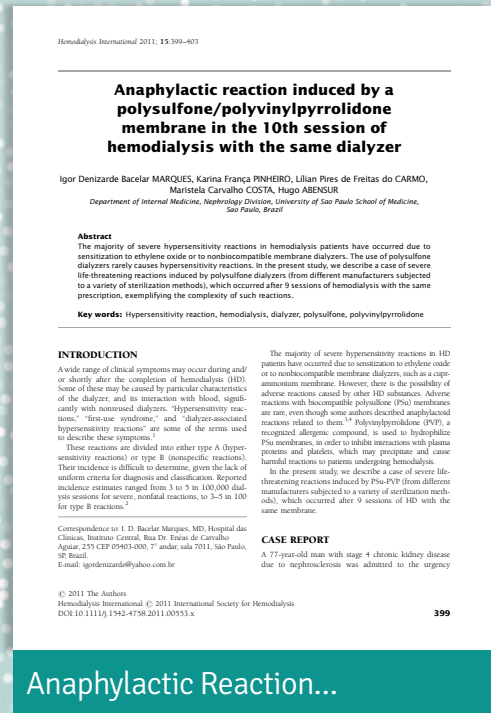


Clinical studies evidences

- Polyvinylpyrrolidone (PVP), a recognized allergenic compound, is used to hydrophilize PSu membranes, in order to inhibit interactions with plasma proteins and platelets, which may precipitate and **cause harmful reactions** to patients undergoing hemodialysis.
- Polyvinylpyrrolidone is a recognized allergenic compound that may be released into circulation during hemodialysis, causing **anaphylaxis**.
- In the present study, we describe a case of **severe life threatening reactions** induced by PSu-PVP (from different manufacturers subjected to a variety of sterilization methods), which occurred after 9 sessions of HD with the same membrane.
- PVP is a well-known allergen used to hydrolyse the membrane and inhibit its interaction with plasma proteins and platelets. Its release into the bloodstream during HD may cause **severe anaphylactic reactions**.
- PVP is leached from synthetic membranes, **especially under specific sterilization conditions**. Furthermore, PVP leaching might be a potential cause of an anaphylactic reaction in a hemodialysis patient.



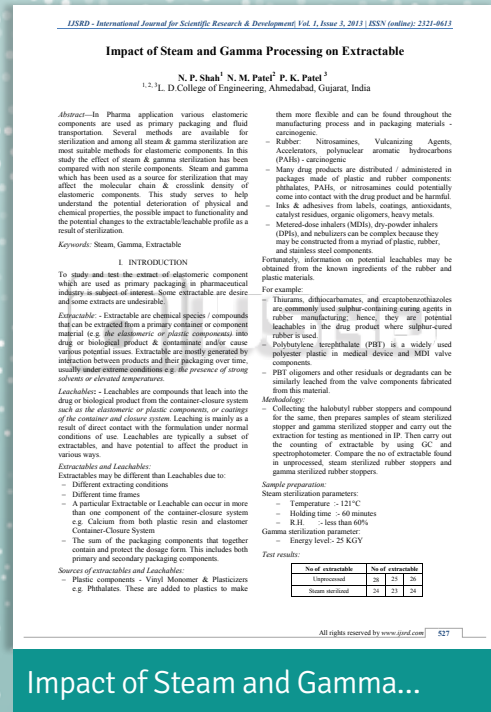
Hypersensitivity Reactions...



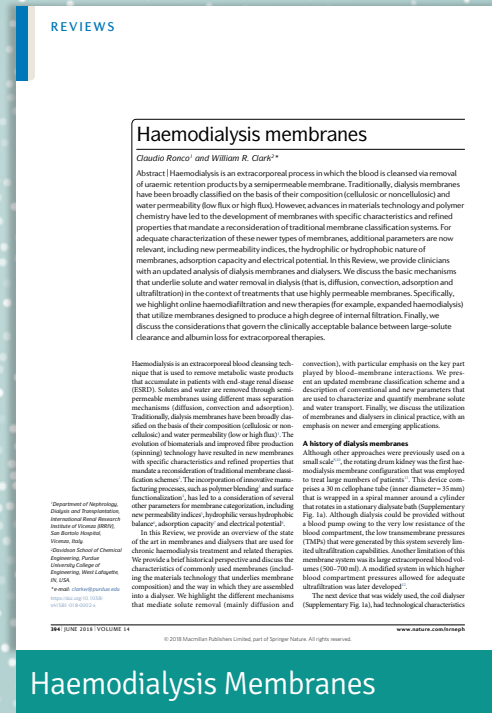
Anaphylactic Reaction...



High-quality Dialysis...



Impact of Steam and Gamma...



Haemodialysis Membranes

What about long term effect of PVP accumulation?

“PVP storage disease” is a disorder occurring in patients who have received high molecular weight PVP, which cannot be excreted from the body. This large polymers deposit in the histiocytes and cause proliferation and infiltrations of histiocytes in the reticuloendothelial system. Prolonged administrations might cause bone destruction, skin lesions, arthritis polyneuropathy, bone marrow failure, myelofibrosis.

American Journal of Hematology 57:68-71 (1998)

Bone Marrow Failure and Myelofibrosis in a Case of PVP Storage Disease

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“PVP storage disease” is a disorder occurring in patients who have received high molecular weight polyvinylpyrrolidone (PVP), which cannot be excreted from the body. These large polymers deposit in the histiocytes and cause proliferation and infiltration of histiocytes in the reticuloendothelial system. There was usually no significant damage to these organs except that prolonged administration might cause bone destruction, skin lesions, arthritis, and polyneuropathy. We describe a patient who had received a large amount of PVP-containing solution for years. Severe bone marrow failure with extensive infiltration of bone marrow by foamy histiocytes occurred later. In addition, she suffered from multiple pathological fractures with spinal cord compression and arthritis of bilateral knee joints. *Am. J. Hematol.* 57:68-71, 1998. © 1998 Wiley-Liss, Inc.

Key words: polyvinylpyrrolidone; myelofibrosis; pathologic fracture

INTRODUCTION

Polyvinylpyrrolidone (PVP) is a polymer of the monomer N-vinylpyrrolidone. It had been used as a plasma expander, or a retarding agent for subcutaneous injection of hormone preparation such as vasopressin [1-6]. High molecular weight PVP can not be eliminated from the kidneys, thus PVP is retained in the reticuloendothelial system (RES). The name “PVP storage disease” is applied to this disease [1-9]. Despite extensive histiocytic accumulation in tissues, no major organ damage had been reported initially [1,2,4-6]. Most damages result from bone destruction, polyneuropathy, arthritis, or granulomatous lesions in the skin [3,4,6-8]. In Taiwan, PVP is prevalent as a plasma expander and several reports have discussed this issue [8-10]. Herein, we describe a patient who had received long-term parenteral administration of a large amount of PVP and in whom heavy infiltration of bone marrow with abnormal histiocytes and bone marrow failure developed. In reviewing the English literature, there are no reports regarding the adverse effect of PVP on the bone marrow.

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CASE REPORT

A 39-year-old Taiwanese female was in good health in the past. Since 1990, she received PVP-containing intravenous solution for nutritional support, which was prescribed by an illegal doctor. Totally, more than 50 bottles (500 ml/bottle, 5% PVP) had been administered. In May 1991, she began to suffer severe generalized bone pain. On examination, she was pale and there was no lymphadenopathy, hepatosplenomegaly, or skin lesions. The extremities and joints were normal. Hemogram showed: Hb 7.0 g/dL, WBC $1.9 \times 10^9/L$ (myelocytes 2%, bands 2%, segmented neutrophils 49%, lymphocytes 40%, monocytes 7%, and normoblasts 2/100 WBC) and platelet count $130 \times 10^9/L$. Biochemical studies were normal. LDH was 59 IU/L (normal 47-140 IU/L). X-ray of chest, shoulder, and pelvis was normal. Bone scan revealed active bilateral hip lesions. Bone marrow aspiration re-

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Other sources of PVP causing “storage disease”

We identified 13 patients with PVP deposition and re-evaluated 31 biopsies and two autopsies. Common indications for biopsy were renal insufficiency, anaemia, pathological fractures, and abdominal complaints. We observed PVP deposits in all biopsies (kidney, hematopoietic bone marrow, bone, gastrointestinal tract, lymph node, and skin) and all sampled tissue from the autopsies. Overall, the clinical findings could be related to PVP deposits in the biopsies. In the most seriously affected patients, PVP deposition caused **severe organ dysfunction and contributed to the fatal outcomes of two patients.**



Comparative Study on Elution of Polyvinylpyrrolidone on Dialyzers Using Ultraviolet Analysis and Iodine Method



Title: Comparative Study on Elution of Polyvinylpyrrolidone on Dialyzers Using Ultraviolet Analysis and Iodine Method
Authors: Allmed Dialysis Technologies GmbH, Pulsnitz, Germany
Publication: ASAIO Journal 2022

We studied the elution of PVP from the following dialyzers:

- Allmed PS160: 1.6m², low flux, steam-sterile
- Fresenius F7HPS: 1.6m², low flux, steam-sterile
- WEGO F16: 1.6m², low flux, gamma-sterile
- BAIN B-16P: 1.6m², low flux, gamma-sterile

All similar age (i.e. similar storage period from date of production) for maximum control of variables

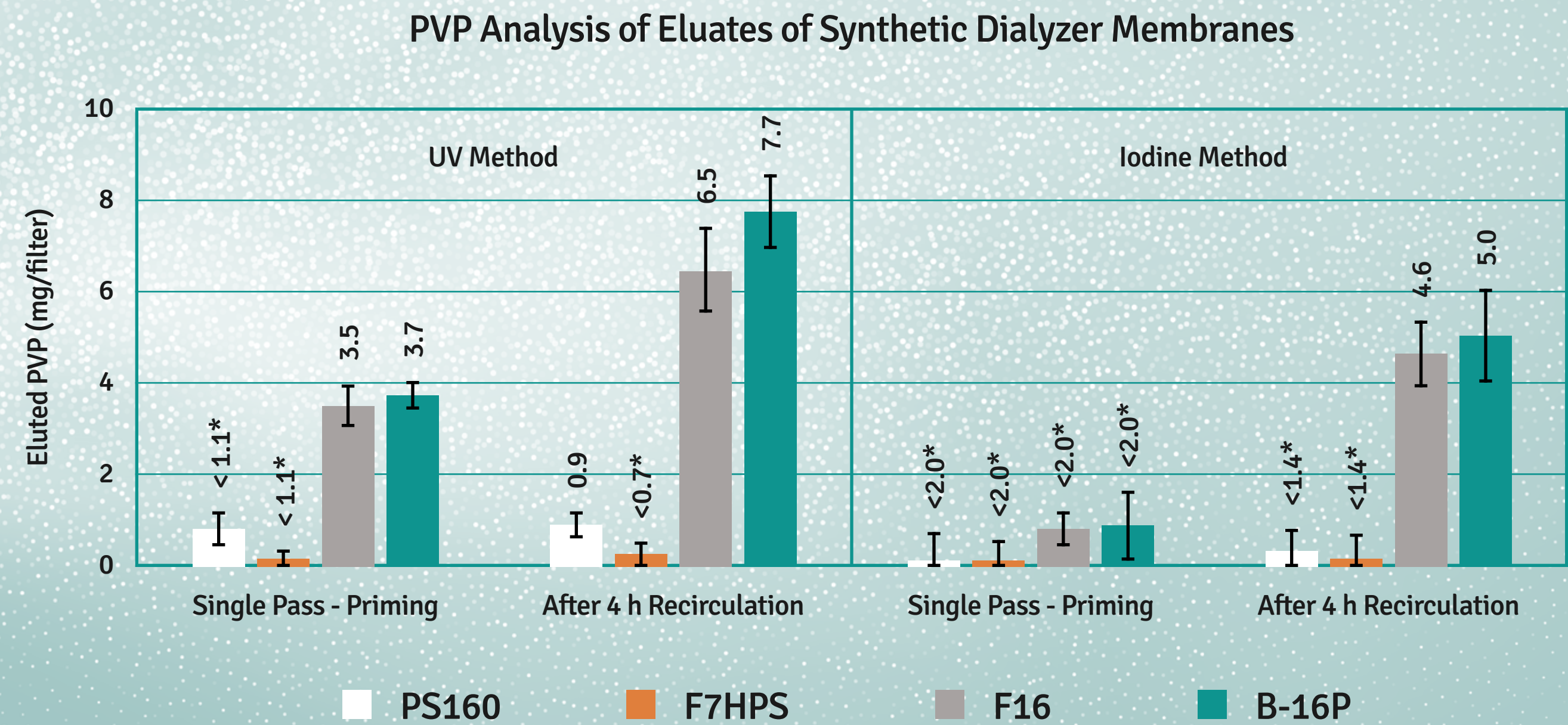
Table 1. Technical Data of Investigated Dialyzers (Per Dialyzers Group, n = 12)

Dialyzer	Flux	Surface Area (m²)	Membrane Material	Sterilization
PS160	Low flux	1.6	PSu	Steam
F7HPS			PSu	Steam
F16			PSu	Irradiation
B-16P			PES	Irradiation
PES, polyethersulfone; PSu, polysulfone				

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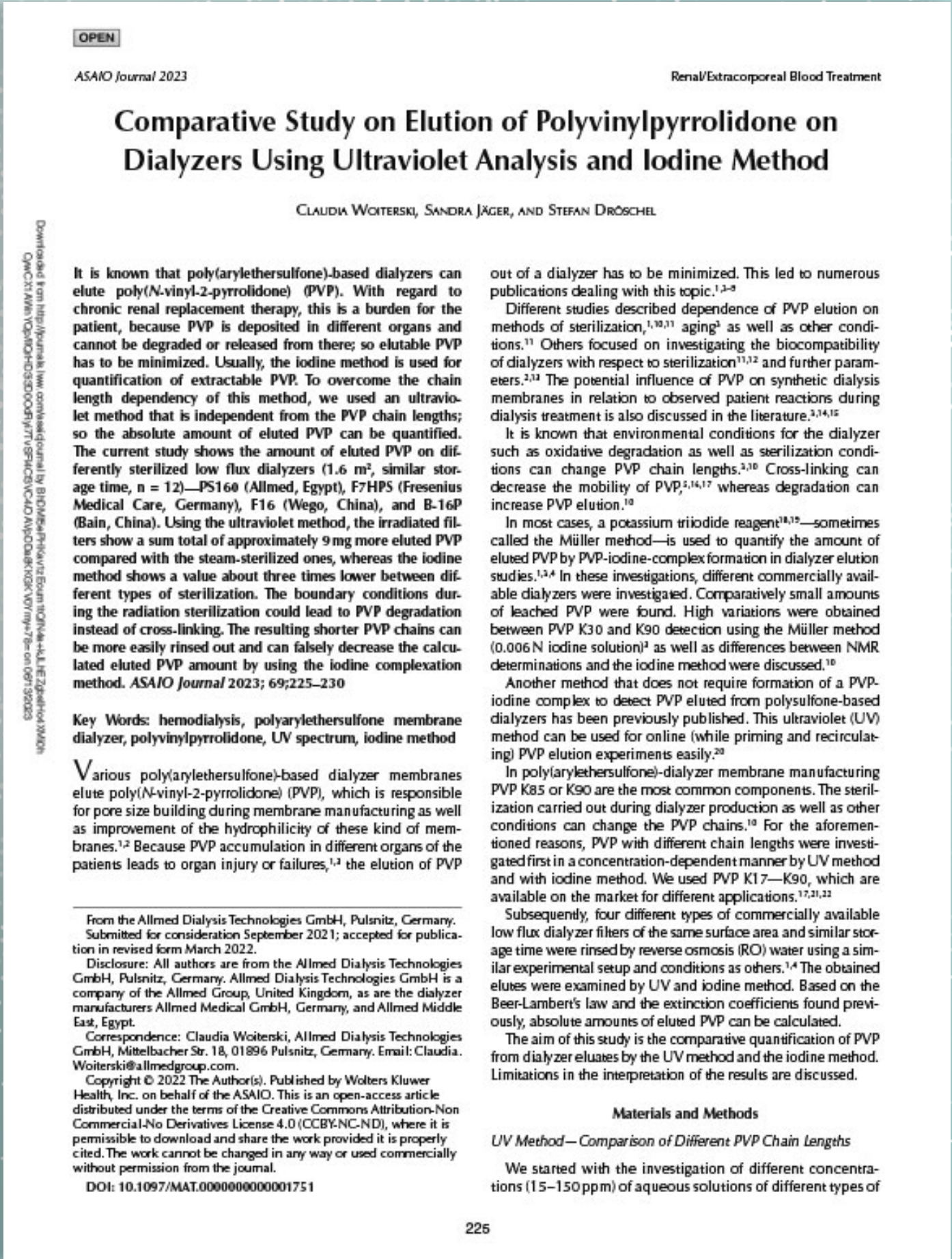


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Take-away messages

- The UV testing method is more reliable than the Iodine testing method (as the UV method is not dependent on the PVP chain lengths, therefore is more fair as a controlled comparison)
- In 4 hour dialysis simulation, the gamma-sterile dialyzers (i.e. WEGO and BAIN) released ~7x more PVP than the steam-sterile dialyzers (i.e. Allmed and Fresenius)
- A patient dialysing on a BAIN or WEGO gamma filter can expect to return home with ~700% more PVP in their body than the one dialysing on an ALLMED or FRESENIUS steam sterilized filter



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Polyvinylpyrrolidone Deposition Disease in Patients With Intravenous Opioid Use: A Case Series	Friedemann Leh MD, Ida Viken Stalund MD, Tormod Karlsen Bjånes MD, PhD, Christian Ohldieck MD, Einar Svarstad MD, PhD, Sabine Leh MD, PhD	Human Pathology	116, 102–111
Comparative Study on Elution of Polyvinylpyrrolidone on Dialyzers Using Ultraviolet Analysis and Iodine Method	Allmed Dialysis Technologies GmbH, Pulsnitz, Germany	ASAIO Journal 2022	N/A

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