May 10, 2022

Fresenius Medical Care Renal Therapies Group, LLC
Denise Oppermann
Senior Director, Regulatory Affairs
920 Winter Street
Waltham, MA 02451

Re: K212620
Trade/Device Name: Citrasate® Liquid Acid Concentrate, NaturaLyte® Liquid Acid Concentrate
Regulation Number: 21 CFR 876.5820
Regulation Name: Hemodialysis system and accessories
Regulatory Class: Class II
Product Code: KPO
Dated: August 17, 2021
Received: August 18, 2021

Dear Denise Oppermann:

We have reviewed your Section 510(k) premarket notification of intent to market the device referenced above and have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments, or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (Act) that do not require approval of a premarket approval application (PMA). You may, therefore, market the device, subject to the general controls provisions of the Act. Although this letter refers to your product as a device, please be aware that some cleared products may instead be combination products. The 510(k) Premarket Notification Database located at https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfpmn/pmn.cfm identifies combination product submissions. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration. Please note: CDRH does not evaluate information related to contract liability warranties. We remind you, however, that device labeling must be truthful and not misleading.

If your device is classified (see above) into either class II (Special Controls) or class III (PMA), it may be subject to additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 898. In addition, FDA may publish further announcements concerning your device in the Federal Register.

Please be advised that FDA's issuance of a substantial equivalence determination does not mean that FDA has made a determination that your device complies with other requirements of the Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the Act's requirements, including, but not limited to: registration and listing (21 CFR Part 807); labeling (21 CFR Part 801); medical device reporting (reporting of medical device-related adverse events) (21 CFR 803) for

devices or postmarketing safety reporting (21 CFR 4, Subpart B) for combination products (see https://www.fda.gov/combination-products/guidance-regulatory-information/postmarketing-safety-reporting-combination-products); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820) for devices or current good manufacturing practices (21 CFR 4, Subpart A) for combination products; and, if applicable, the electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR 1000-1050.

Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR Part 807.97). For questions regarding the reporting of adverse events under the MDR regulation (21 CFR Part 803), please go to https://www.fda.gov/medical-devices/medical-device-safety/medical-device-reporting-mdr-how-report-medical-device-problems.

For comprehensive regulatory information about medical devices and radiation-emitting products, including information about labeling regulations, please see Device Advice (https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance) and CDRH Learn (https://www.fda.gov/training-and-continuing-education/cdrh-learn). Additionally, you may contact the Division of Industry and Consumer Education (DICE) to ask a question about a specific regulatory topic. See the DICE website (https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance/contact-us-division-industry-and-consumer-education-dice) for more information or contact DICE by email (DICE@fda.hhs.gov) or phone (1-800-638-2041 or 301-796-7100).

Sincerely,

Gema Gonzalez, MS
Acting Assistant Director
DHT3A: Division of Renal, Gastrointestinal,
Obesity and Transplant Devices
OHT3: Office of GastroRenal, ObGyn,
General Hospital and Urology Devices
Office of Product Evaluation and Quality
Center for Devices and Radiological Health

Enclosure

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Food and Drug Administration

Indications for Use

Form Approved: OMB No. 0910-0120
Expiration Date: 06/30/2023
See PRA Statement below.

510(k) Number *(if known)*
K212620

Device Name
Citrasate® Liquid Acid Concentrate
NaturaLyte® Liquid Acid Concentrate

Indications for Use *(Describe)*
Citrasate® Liquid Acid Concentrate is indicated for use in patients undergoing extracorporeal bicarbonate hemodialysis for acute and chronic renal failure. Citrasate® Liquid Acid Concentrate is intended to be used as one component in the preparation of dialysate in a 3-stream proportioning hemodialysis machine according to a physician's prescription.

NaturaLyte® Liquid Acid Concentrate is indicated for use in patients undergoing extracorporeal bicarbonate hemodialysis for acute and chronic renal failure. NaturaLyte® Liquid Acid Concentrate is intended to be used as one component in the preparation of dialysate in a 3-stream proportioning hemodialysis machine according to a physician's prescription.

Type of Use *(Select one or both, as applicable)*

☒ Prescription Use (Part 21 CFR 801 Subpart D) ☐ Over-The-Counter Use (21 CFR 801 Subpart C)

CONTINUE ON A SEPARATE PAGE IF NEEDED.

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5. 510(K) SUMMARY

This 510(k) Summary is in accordance with the requirements of the Safe Medical Device Act (SMDA) of 1990. The content of this 510(k) summary is provided in conformance with 21 CFR § 807.92.

5.1. Submitter's Information

Name:	Fresenius Medical Care Renal Therapies Group, LLC
Address:	920 Winter Street Waltham, MA 02451-1457
Phone:	(781) 996-9103
Fax:	(781) 699-9635
Contact Person:	Denise Oppermann, Senior Director
Preparation Date:	17 August 2021

5.2. Device Name

Trade Name:	Citrasate® Liquid Acid Concentrate NaturaLyte® Liquid Acid Concentrate
Common Name:	Liquid Acid Concentrates
Regulation Name:	Hemodialysis system and accessories
Regulatory Class:	Class II per 21 CFR § 876.5820
Product Code:	KPO
Product Code Name:	Dialysate Concentrate for Hemodialysis (Liquid or Powder)
FDA Review Panel:	Gastroenterology/Urology

5.3. Legally Marketed Predicate Device

The legally marketed predicate devices are the Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate cleared under K192017.

These devices are not currently subject to a design-related recall.

5.4. Device Description

5.4.1. Device Identification- Citrasate

The Citrasate Liquid Acid Concentrate product line consists of three (3) formulations that differ in concentrations of potassium chloride. Each formulation is offered in two (2) presentations—a 1-gallon high density polyethylene bottle and a 55-gallon high density polyethylene drum—for a total of six (6) product codes. Only the bottle presentation is the subject of this 510(k). Descriptions of the available Citrasate Liquid Acid Concentrate bottle formulations are provided in Table 1.

Table 1: Citrasate Liquid Acid Concentrate Products (1-Gallon Bottles)

Part Number	Part Number Description
08-1251-CA	Citrasate Liquid Acid – 1.0 K, 2.5 Ca, 1.0 Mg – 1-gal bottle
08-2251-CA	Citrasate Liquid Acid – 2.0 K, 2.5 Ca, 1.0 Mg – 1-gal bottle
08-3251-CA	Citrasate Liquid Acid – 3.0 K, 2.5 Ca, 1.0 Mg – 1-gal bottle

5.4.2. Device Identification- NaturaLyte

The NaturaLyte Liquid Acid Concentrate product line consists of 16 formulations that differ in concentrations of potassium chloride and calcium chloride. All formulations are offered in a 1-gallon high density polyethylene bottle and six (6) formulations are offered in a 55-gallon high density polyethylene drum, for a total of 22 product codes. Only the bottle presentation is the subject of this 510(k). Descriptions of the available NaturaLyte Liquid Acid Concentrate bottle formulations are provided in Table 2.

Table 2: NaturaLyte Liquid Acid Concentrate Products (1-Gallon Bottles)

Part Number	Part Number Description
08-0231-4	NaturaLyte Liquid Acid – 0.0 K, 2.25 Ca, 1.0 Mg – 1-gal bottle
08-1001-0	NaturaLyte Liquid Acid – 1.0 K, 0.0 Ca, 1.0 Mg – 1- gal bottle
08-1201-8	NaturaLyte Liquid Acid – 1.0 K, 2.0 Ca, 1.0 Mg – 1- gal bottle
08-1231-3	NaturaLyte Liquid Acid – 1.0 K, 2.25 Ca, 1.0 Mg – 1-gal bottle
08-1251-1	NaturaLyte Liquid Acid – 1.0 K, 2.5 Ca, 1.0 Mg – 1-gal bottle
08-1301-4	NaturaLyte Liquid Acid – 1.0 K, 3.0 Ca, 1.0 Mg – 1-gal bottle
08-2201-5	NaturaLyte Liquid Acid – 2.0 K, 2.0 Ca, 1.0 Mg – 1-gal bottle
08-2231-2	NaturaLyte Liquid Acid – 2.0 K, 2.25 Ca, 1.0 Mg – 1-gal bottle
08-2251-0	NaturaLyte Liquid Acid – 2.0 K, 2.5 Ca, 1.0 Mg – 1-gal bottle
08-2301-3	NaturaLyte Liquid Acid – 2.0 K, 3.0 Ca, 1.0 Mg – 1-gal bottle
08-2351-8	NaturaLyte Liquid Acid – 2.0 K, 3.5 Ca, 1.0 Mg – 1-gal bottle
08-3201-4	NaturaLyte Liquid Acid – 3.0 K, 2.0 Ca, 1.0 Mg – 1-gal bottle
08-3231-1	NaturaLyte Liquid Acid – 3.0 K, 2.25 Ca, 1.0 Mg – 1-gal bottle
08-3251-9	NaturaLyte Liquid Acid – 3.0 K, 2.5 Ca, 1.0 Mg – 1-gal bottle
08-3301-2	NaturaLyte Liquid Acid – 3.0 K, 3.0 Ca, 1.0 Mg – 1-gal bottle
08-4231-0	NaturaLyte Liquid Acid – 4.0 K, 2.25 Ca, 1.0 Mg – 1-gal bottle

5.4.3. Device Characteristics

Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate products are single-use, non-sterile devices intended for use in hemodialysis therapy for acute and chronic renal failure. Both products consist of electrolytes (chloride salts of sodium, calcium, magnesium, and potassium), dextrose, and an organic acid source (citric acid in Citrasate and acetic acid in NaturaLyte). Citrasate also contains sodium acetate as a secondary pH adjuster.

All formulation components are mixed in a single solution with dialysis quality water and provided to the customer ready for use.

5.4.4. Environment of Use

Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate are used in environments where acute and chronic hemodialysis is performed.

5.4.5. Brief Written Description of the Device

Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate are each intended to be used as one (1) component in the preparation of dialysate in a 3-stream proportioning hemodialysis machine according to a physician's prescription. Both concentrates are formulated for use in 45X proportioning systems which proportion a nominal ratio of 1 : 1.72 : 42.28 (acid : bicarbonate : water) to generate dialysate. The dialysate is intended to be pumped through a dialyzer, creating an osmotic gradient across the dialyzer membrane to exchange solutes with blood during hemodialysis.

The proposed Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate 1-gallon bottles have a modified cap design with alternate raw materials. The proposed bottle cap is composed of high density polyethylene (HDPE). The tamper-evident cap has a grooved ring pull tab intended to provide a thread lock. Due to the difference in cap design, the bottle threads are modified to match the threads and dimensions of the proposed cap. Dimensional changes are limited to the threads and bottle termination area only and do not affect the main bottle dimensions. There is no change in wall thickness or material used to manufacture the Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate 1-gallon bottles.

5.4.6. Materials of Use

Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate are classified as externally communicating, blood path indirect, prolonged contact (>24 hours to 30 days) duration, Class II (Category B) devices in accordance with FDA guidance document *Use of International Standard ISO 10993-1, "Biological evaluation of medical devices-Part 1: Evaluation and testing within a risk management process*" (04 September 2020). Packaging for the Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate bottles consists of the following materials:

- 1-gallon bottle – high density polyethylene
- Bottle cap – high density polyethylene

Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate are composed of USP grade raw chemicals. Purified water meeting the requirements of ISO 13959 is used in the manufacture of Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate.

5.4.7. Key Performance Specifications/Characteristics

Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate are each used as a component of the dialysate for hemodialysis treatments. Both concentrates are intended to be used in 45X proportioning systems which proportion a nominal ratio of 1 : 1.72 : 42.28 (acid : bicarbonate : water) to generate dialysate. The water used for the final dialysate meets ISO 13959 or ANSI/AAMI RD62 requirements.

5.5. Intended Use

Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate are each intended for use in hemodialysis therapy for acute and chronic renal failure.

5.6. Indications for Use

Citrasate® Liquid Acid Concentrate is indicated for use in patients undergoing extracorporeal bicarbonate hemodialysis for acute and chronic renal failure. Citrasate® Liquid Acid Concentrate is intended to be used as one component in the preparation of dialysate in a 3-stream proportioning hemodialysis machine according to a physician's prescription.

NaturaLyte® Liquid Acid Concentrate is indicated for use in patients undergoing extracorporeal bicarbonate hemodialysis for acute and chronic renal failure. NaturaLyte® Liquid Acid Concentrate is intended to be used as one component in the preparation of dialysate in a 3-stream proportioning hemodialysis machine according to a physician's prescription.

5.7. Comparison of Technological Characteristics with the Predicate Device

The Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate are substantially equivalent to the predicate devices (K192017) with regard to the following technological characteristics:

- Intended use
- Design
- Principle of operation
- Materials of construction
- Performance specifications

5.8. Performance Data

Performance testing was conducted for the Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate products. Results of performance testing support substantial equivalence, safety, and efficacy of the Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate.

5.8.1. Stability Design Verification

Stability evaluations were conducted for Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate to support the 24-month (2-year) shelf life. Stability is monitored as part of routine production testing.

5.8.2. Shipping Verification

Shipping and distribution verification testing was performed for the Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate products in accordance with *ASTM D4169-16, Standard Practice for Performance Testing of Shipping Containers and Systems.* Results support that the products' packaging is able to withstand the distribution environment.

5.8.3. Biocompatibility Testing

Biocompatibility testing was conducted in accordance with ISO 10993-1:2018 and FDA guidance document *Use of International Standard ISO 10993-1, "Biological evaluation of medical devices – Part 1: Evaluation and testing within a risk management process"* (04 September 2020). The following endpoints were assessed to support the biological safety of the Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate bottles:

- Chemical characterization
- Cytotoxicity
- Sensitization
- Irritation
- Systemic toxicity
- Material mediated pyrogenicity
- Hemocompatibility

A toxicological risk assessment was also performed.

5.8.4. Human Factors Validation Testing

A Human Factors assessment was conducted for the Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate to demonstrate their safe and effective use in accordance with FDA guidance document *Applying Human Factors and Usability Engineering to Medical Devices* (03 February 2016).

5.8.5. Electrical Safety and Electromagnetic Compatibility (EMC)

Not applicable. Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate are not electrical mechanical devices.

5.8.6. Software Verification and Validation Testing

Not applicable. Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate do not contain software.

5.8.7. Animal Studies

No animal studies were performed for Citrasate Liquid Acid Concentrate or NaturaLyte Liquid Acid Concentrate.

5.8.8. Clinical Studies

No clinical studies were performed for Citrasate Liquid Acid Concentrate or NaturaLyte Liquid Acid Concentrate.

5.9. Conclusion

The intended use, design, principle of operation, and materials of construction of the Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate are substantially equivalent to those of the predicate devices. Differences between the Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate and the predicates do not raise new concerns with regard to safety or efficacy. FMCRTG concludes that within the meaning of the Medical Device Amendments Act of 1976, Citrasate Liquid Acid Concentrate and NaturaLyte Liquid Acid Concentrate are safe and effective for their intended use.