What is claimed is:

1. A Form kappa of rifaximin, a Form theta and/or a rifaximin:piperazine cocrystal.

2. A compound according to claim 1, wherein form kappa is characterized by an XRPD substantially similar to 1, 2, 3, 10 and 16 or is characterized by a DSC or TGA Thermogram substantially similar to Figures 6, 7, 11, 12 and 13.

3. A compound of claim 1, wherein form kappa of rifaximin is characterized by the peaks listed in Table 3 or Table 4.

4. A compound of claim 1, wherein form kappa of rifaximin exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.10 degree θ) at (6.45 - 6.67) ± 0.20, (6.83 - 6.94) ± 0.20 and (7.68 - 7.78) ± 0.20; (6.45 - 6.67) ± 0.20, (6.83 - 6.94) ± 0.20 and (18.46 - 18.61) ± 0.20; (6.45 - 6.67) ± 0.20, (6.83 - 6.94) ± 0.20 and (7.52 - 7.56) ± 0.20; (6.83 - 6.94) ± 0.20, (7.68 - 7.78) ± 0.20 and (18.46 - 18.61) ± 0.20; (6.45 - 6.67) ± 0.20, (6.83 - 6.94) ± 0.20, (7.68 - 7.78) ± 0.20 and (18.46 - 18.61) ± 0.20; (6.83 - 6.94) ± 0.20, (7.52 - 7.56) ± 0.20, (7.68 - 7.78) ± 0.20 and (18.46 - 18.61) ± 0.20; (6.45 - 6.67) ± 0.20, (6.83 - 6.94) ± 0.20, (7.52 - 7.56) ± 0.20, (7.68 - 7.78) ± 0.20 and (18.46 - 18.61) ± 0.20; (6.45 - 6.67) ± 0.20, (6.83 - 6.94) ± 0.20, (7.52 - 7.56) ± 0.20, (7.68 - 7.78) ± 0.20, (8.30 - 8.34) ± 0.20 and (18.46 - 18.61) ± 0.20; or (5.41 - 5.65) ± 0.20, (6.45 - 6.67) ± 0.20, (6.83 - 6.94) ± 0.20, (7.52 - 7.56) ± 0.20, (7.68 - 7.78) ± 0.20, (8.30 - 8.34) ± 0.20 and (18.46 - 18.61) ± 0.20.

5. A compound according to claim 1, wherein the rifaximin:piperazine cocrystal is characterized by an XRPD substantially similar to Figures 17 and 18.

6. A compound according to claim 1, wherein the rifaximin:piperazine cocrystal comprises cocrystal 1.

7. The compound according to claim 6, wherein the rifaximin:piperazine cocrystal 1 is characterized by an XRPD substantially similar to one or more of Figures 19, 23, 25, 30 and/or 48.

8. The compound according to claim 6, wherein the rifaximin:piperazine cocrystal 1 is characterized by IR spectra substantially similar to Figure 21 and/or Figure 33; or by Raman spectra substantially similar to Figure 22, Figure 35 and/or one or more peaks of Figure 30.

9. The compound according to claim 6, wherein the rifaximin:piperazine cocrystal 1 exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.10 degree θ) comprising one or more peaks listed in Figure 26 or Figure 27.

10. The compound according to claim 8, wherein the rifaximin:piperazine cocrystal 1 exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.10 degree θ) at 5.74 ± 0.10; 6.58 ± 0.10; 7.49 ± 0.10; 8.21 ± 0.10; and 9.83 ± 0.10; or 5.74 ± 0.10; 7.49 ± 0.10; 8.21 ± 0.10; and 9.83 ± 0.10; or 5.74 ± 0.10; 6.58 ± 0.10; 8.21 ± 0.10; and 9.83 ± 0.10; or 5.74 ± 0.10; 6.58 ± 0.10; 7.49 ± 0.10; and 9.83 ± 0.10; or 5.74 ± 0.10; 6.58 ± 0.10; 7.49 ± 0.10; and 8.21 ± 0.10.

11. The compound according to claim 6, wherein the rifaximin:piperazine cocrystal 1 characterized by DSC and TGA curves substantially similar to Figure 28; or by DVS curves substantially similar to Figure 29; or by NMR spectra substantially similar to Figure 31 or by SSNMR substantially similar to Figure 32.

12. The compound according to claim 6, wherein the rifaximin:piperazine cocrystal 1 exhibiting IR spectrum peaks as shown in Figure 34.

13. A compound according to claim 1, wherein the rifaximin:piperazine cocrystal comprises cocrystal 2.

14. The compound according to claim 13, wherein the rifaximin:piperazine cocrystal 2 is characterized by an XRPD substantially similar to one or more of Figures 19, 20, 37 and/or 39; or by IR spectra substantially similar to Figure 21 and/or Figure 44; or by Raman spectra substantially similar to Figure 22, Figure 46 and/or one or more peaks of Figure 47 or by DSC and TGA curves substantially similar to Figure 42 or by NMR spectra substantially similar to Figure 43.

15. The compound according to claim 13, wherein the rifaximin:piperazine cocrystal 2 exhibiting IR spectrum peaks as shown in Figure 45.

16. The compound according to claim 13, wherein the rifaximin:piperazine cocrystal 2 exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.10 degree θ) comprising one or more peaks listed in Figure 40 or Figure 41.

17. The compound according to claim 13, wherein the rifaximin:piperazine cocrystal 2 exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.10 degree θ) at 3.64 ± 0.10; 5.58 ± 0.10; 6.45 ± 0.10; 7.29 ± 0.10; 7.60 ± 0.10; 8.27 ± 0.10; and 9.01 ± 0.10; or 5.58 ± 0.10; 6.45 ± 0.10; 7.29 ± 0.10; 7.60 ± 0.10; 8.27 ± 0.10; and 9.01 ± 0.10; or 3.64 ± 0.10; 6.45 ± 0.10; 7.29 ± 0.10; 7.60 ± 0.10; 8.27 ± 0.10; and 9.01 ± 0.10; or 3.64 ± 0.10; 5.58 ± 0.10; 7.29 ± 0.10; 7.60 ± 0.10; 8.27 ± 0.10; and 9.01 ± 0.10; or 3.64 ± 0.10; 5.58 ± 0.10; 6.45 ± 0.10; 7.60 ± 0.10; 8.27 ± 0.10; and 9.01 ± 0.10; or 3.64 ± 0.10; 5.58 ± 0.10; 6.45 ± 0.10; 7.29 ± 0.10; 7.60 ± 0.10; and 9.01 ± 0.10; or 3.64 ± 0.10; 5.58 ± 0.10; 6.45 ± 0.10; 7.29 ± 0.10; 7.60 ± 0.10; and 8.27 ± 0.10; or 3.64 ± 0.10; 5.58 ± 0.10; 6.45 ± 0.10; 7.29 ± 0.10; and 7.60 ± 0.10.

18. A compound according to claim 1, wherein Form kappa of rifaximin, Form theta and/or a rifaximin:piperazine cocrystal contain less than 5% by weight total impurities.

19. A compound according to claim 1, wherein Form kappa of rifaximin, Form theta and/or a rifaximin:piperazine cocrystal is at least 50% pure, or at least 75% pure, or at least 80% pure, or at least 90% pure, or at least 95% pure, or at least 98% pure.

20. A compound according to claim 1, wherein Form kappa of rifaximin, a Form theta and/or a rifaximin:piperazine cocrystal further comprise a pharmaceutically acceptable carrier.

21. A compound according to claim 1, wherein one or more of Form kappa of rifaximin, Form theta and/or a rifaximin:piperazine cocrystal are formulated as coated or uncoated tablets, hard or soft gelatin capsules, sugar-coated pills, lozenges, wafer sheets, pellets or powders in sealed packets.

22. A process for producing Form Kappa of rifaximin comprising one or more of the methods listed in Tables 1 and 2.

23. A process for producing a rifaximin:piperazine cocrystal comprising one or more of the methods listed in Table 10.

24. The form theta of claim 1, wherein the theta is characterized by an XRPD substantially similar to Figures 60 or 68.

25. The Form theta of claim 1, wherein the theta form of rifaximin exhibits an X-ray powder diffraction pattern having one or more of the following characteristic peaks expressed in degrees 2θ (+/- 0.10 degree 0) at 5.48 ± 0.10, 7.00 ± 0.10, 7.75 ± 0.10, 8.72 ± 0.10, 9.09 ± 0.10, or 10.96 ± 0.10 or; 5.48 ± 0.10, 7.00 ± 0.10, 7.75 ± 0.10, 8.72 ± 0.10, 9.09 ± 0.10, and 10.96 ± 0.10; or 5.48 ± 0.10, 7.00 ± 0.10, 7.75 ± 0.10, or 5.48 ± 0.10, 7.75 ± 0.10, and 8.72 ± 0.10; or 5.48 ± 0.10, 7.00 ± 0.10, and 8.72 ± 0.10; or 5.48 ± 0.10, 8.72 ± 0.10, and 9.09 ± 0.10; or 5.48 ± 0.10, 9.09 ± 0.10, and 10.96 ± 0.10; or 7.75 ± 0.10, 8.72 ± 0.10, and 9.09 ± 0.10; or 7.00 ± 0.10, 7.75 ± 0.10, 8.72 ± 0.10, and 10.96 ± 0.10; or 8.72 ± 0.10, 9.09 ± 0.10, and 10.96 ± 0.10; or 7.00 ± 0.10, 7.75 ± 0.10, 8.72 ± 0.10, and 10.96 ± 0.10; or 7.00 ± 0.10, 8.72 ± 0.10, and 10.96 ± 0.10.

26. The Form theta of claim 1, wherein Form theta is characterized by a DSC substantially similar to Figure 70 and/ or a TGA substantially similar to Figure 70 and/or a moisture sorption XRPD substantially similar to Figure 71 and/or a post-moisture sorption XRPD substantially similar to Figure 72.

27. Form theta of claim 1, comprising one or more of the peaks identified inTable 24 or 25..

What is claimed is:

1. A rifaximin polymorph Form kappa, a rifaximin polymorph Form theta, a rifaximin:piperazine cocrystal 1 or a rifaximin:piperazine cocrystal 2 wherein:

the polymorph Form kappa exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ at

6.45-6.67, 6.83-6.94 and 7.68-7.78;
6.45-6.67, 6.83-6.94 and 18.46-18.61;
6.45-6.67, 6.83-6.94 and 7.52-7.56;
6.83-6.94, 7.68-7.78 and 18.46-18.61;
6.45-6.67, 6.83-6.94, 7.68-7.78 and 18.46-18.61;
6.83-6.94, 7.52-7.56, 7.68-7.78 and 18.46-18.61;
6.45-6.67, 6.83-6.94, 7.52-7.56, 7.68-7.78 and 18.46-18.61;
6.45-6.67, 6.83-6.94, 7.52-7.56, 7.68-7.78, 8.30-8.34 and 18.46-18.61; or
5.41-5.65, 6.45-6.67, 6.83-6.94, 7.52-7.56, 7.68-7.78, 8.30-8.34 and 18.46-18.61;

the polymorph Form theta exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ at

5.48, 7.00, 7.75, 8.72, 9.09, or 10.96;
5.48, 7.00, 7.75, 8.72, 9.09, and 10.96;
5.48, 7.00, 7.75, or 5.48, 7.75, and 8.72;
5.48, 7.00, and 8.72;
5.48, 8.72, and 9.09;
5.48, 9.09, and 10.96;
7.75, 8.72, and 9.09;
7.00, 7.75, 8.72, and 10.96;
8.72, 9.09, and 10.96;
7.00, 7.75, 8.72, and 10.96; or
7.00, 8.72, and 10.96;

the rifaximin:piperazine cocrystal 1 exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ at

5.74, 6.58, 7.49, 8.21, and 9.83;
5.74, 7.49, 8.21, and 9.83;

5.74, 6.58, 8.21, and 9.83;
5.74, 6.58, 7.49, and 9.83; or
5.74, 6.58, 7.49, and 8.21; and

the rifaximin:piperazine cocrystal 2 exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ at

3.64, 5.58, 6.45, 7.29, 7.60, 8.27, and 9.01;
5.58, 6.45, 7.29, 7.60, 8.27, and 9.01;
3.64, 6.45, 7.29, 7.60, 8.27, and 9.01;
3.64, 5.58, 7.29, 7.60, 8.27, and 9.01;
3.64, 5.58, 6.45, 7.60, 8.27, and 9.01;
3.64, 5.58, 6.45, 7.29, 7.60, and 9.01;
3.64, 5.58, 6.45, 7.29, 7.60, and 8.27; or
3.64, 5.58, 6.45, 7.29, and 7.60.

2. The rifaximin polymorph Form kappa, Form theta, rifaximin:piperazine cocrystal 1 or rifaximin:piperazine cocrystal 2 according to claim 1, containing less than 5% by weight total impurities.

3. The rifaximin polymorph Form kappa, Form theta, rifaximin:piperazine cocrystal 1 or rifaximin:piperazine cocrystal 2 according to claim 1, wherein the compound is at least 50% pure, or at least 75% pure, or at least 80% pure, or at least 90% pure, or at least 95% pure, or at least 98% pure.

4. A pharmaceutical composition comprising the rifaximin polymorph Form kappa, Form theta, rifaximin:piperazine cocrystal 1 or rifaximin:piperazine cocrystal 2 according to claim 1; and a pharmaceutically acceptable carrier.

5. The composition according to claim 1, wherein one or more of rifaximin polymorph Form kappa, Form theta, rifaximin:piperazine cocrystal 1 or rifaximin:piperazine cocrystal 2 are formulated as coated or uncoated tablets, hard or soft gelatin capsules, sugar-coated pills, lozenges, wafer sheets, pellets or powders in sealed packets.

6. A process for producing rifaximin polymorph Form kappa of claim 1, comprising agitating

rifaximin polymorph Form a of rifaximin below 60° C until a precipitate results; and filtering said precipitate.